Missouri Department of Natural Resources
Regulatory Impact Report
In Preparation for Proposing
Amendments of the Existing Rule 10 CSR 20-7.031

Division/Program: Environmental Quality/Water Protection Program

Rule numbers: 10 CSR 20-7.031

Rule titles: Water Quality Standards

Type of rule actions: Rule Amendments

Nature of the rulemaking: Proposed changes to selected parts of the regulation are based on stakeholder interest, general updates and EPA disapproval actions.

Approval of the Regulatory Impact Report:

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Program Director Date

Missouri Department of Natural Resources

Regulatory Impact Report

In Preparation for Proposing
Amendments of the Existing Rule 10 CSR 20-7.031

Applicability: Pursuant to Section 640.015 RSMo, "all rulemakings that prescribe environmental conditions or standards promulgated by the Department of Natural Resources…shall… be based on the regulatory impact report…." This requirement shall not apply to emergency rulemakings pursuant to section 536.025 or to rules of other applicable federal agencies adopted by the Department "without variance."

Determination: The Missouri Department of Natural Resources has determined these rulemakings prescribe environmental conditions or standards. Due to the complexity of the text and several changes, the Department has produced this Regulatory Impact Report to provide the public with specific explanations of the changes that are proposed and how they would be incorporated into the rule. The Regulatory Impact Report will be made publicly available for comment for a period of at least 60 days. Upon completion of the comment period, official responses will be developed and made available on the agency web page prior to filing the proposed rulemakings with the Secretary of State. Contact information is at the end of this regulatory impact report.

1. Describe the environmental conditions or standards being prescribed.

This rulemaking includes revisions that ensure that state water quality standards (WQS) are functionally equivalent to federal standards and that improve the clarity, specificity and effectiveness of the WQS. In summary, the revisions include the following:

a. Waters of the State Definition

The proposed rule revises the definition of "Waters of the state" at 10 CSR 20-7.031(1)(DD) to incorporate by reference the current definition found in state statute at section 644.016 Missouri Revised Statutes. The proposed revision is a result of legislation (2015 HB 92) passed to change the definition of waters of the state in Missouri statute [RSMo 644.016(27)]. Referencing the definition of waters of the state at section 644.016 RSMo provides consistency in wording between state statute and regulation, and avoids any conflicts or inconsistencies that may arise between them.

b. Mixing Zones and Zones of Initial Dilution

The proposed rule clarifies the physical dimensions and requirements for mixing zones and zones of initial dilution. The revision primarily updates the rule at 10 CSR 20-7.031(5)(A)4.B.(III) to allow site-specific mixing zone determinations at stream flows greater than 20 cubic feet per second. This item was requested by stakeholders. Revisions to the mixing zone provisions at 10 CSR 20-7.031(5)(A)4.E. help to clarify that these limited areas permitted for mixing and dilution must be free of organisms sensitive to the pollutant(s) being discharged.

c. Hardness

The proposed rule changes the hardness derivation methodology from a twenty-fifth percentile to a median. This revision would change the definition and derivation methodology for hardness at 10 CSR 20-7.031(1)(BB) from a lower quartile (twenty-fifth percentile) to a median (fiftieth percentile) value. The revision also clarifies that hardness values will be considered representative if collected from similar waters within the same ecoregion. This item was requested by stakeholders and affects the derivation of hardness dependent metals criteria found in Table A1.

d. pH

The proposed revision to specific criteria for pH at 10 CSR 20-7.031(5)(E) clarifies the criteria shall be considered a four-day average concentration of representative samples. The revision further clarifies that the specific criteria for pH are chronic toxicity criteria. This item was requested by stakeholders.

e. General Criteria Revisions

The proposed rule includes three revisions to the general (narrative) criteria at 10 CSR 20-7.031(4). The first revision recognizes that chronically toxic conditions may exist in mixing zones where authorized by permit and acutely toxic conditions may exist in zones of initial dilution where authorized by permit. The revision would update the rule at 10 CSR 20-7.031(4)(D) to clarify that acute toxicity may be allowed by permit in zones of initial dilution and that chronic toxicity may be allowed by permit in mixing zones. This item was requested by stakeholders.

The second general criteria revision adds a section at 10 CSR 20-7.031(4)(E) that clarifies the applicability of narrative criteria with regard to nutrients. As noted during the numeric nutrient criteria stakeholder process, Missouri's general water quality criteria are one of the "key components of an existing, comprehensive state strategy to achieve nutrient load reductions." The department agrees that the general water quality criteria play a vital role in protecting waters of the state and are applicable towards prevention of nutrient enrichment. The proposed revision clarifies this agreement in the water quality standards regulation.

The third general criteria revision adds a section at 10 CSR 20-7.031(4)(F) to ensure protections for downstream uses are included in the water quality standards as required by the federal clean water act. EPA interprets 40 CFR 131.10(b) to require that states consider and ensure the protection of downstream water quality during the development of designated uses and water quality criteria. With respect to adopting criteria to protect downstream waters, states have the discretion in choosing either narrative or numeric criteria to demonstrate consistency with 40 CFR 131.10(b). Narrative criteria provide the most flexibility for ensuring compliance with respect to downstream use protections since individual water body and pollutant approaches are highly site-specific and information/data intensive. Narrative criteria approaches are also adaptive, providing regulatory coverage and assurance for a variety of water bodies, pollutants, and flow conditions.

f. Antidegradation Implementation Procedure

The proposed revision updates reference to Missouri's Antidegradation Implementation Procedure (AIP) at 10 CSR 20-7.031(3)(D). The updated rule reference incorporates the July 13, 2016 approval date of the revised AIP by the Missouri Clean Water Commission. Revisions to the AIP were required following notification by the Environmental Protection Agency (EPA) that the *de minimis* provision in Missouri's AIP makes no distinction between bioaccumulative versus non-bioaccumulative pollutants. EPA's notification of the issue was the result of a lawsuit in the State of Idaho [*Greater Yellowstone Coalition* v. *EPA,* Case No. 4: 12-cv-60 (D. Idaho)] and EPA disapproval of *de minimis* antidegradation implementation methods in that state as a result of the lawsuit. Adoption and reference to an approved AIP should satisfy EPA's concerns on the document and result in EPA approval for the procedure.

g. Losing Stream Reference and Table J

The proposed revision updates the definition of 'Losing Stream' at 10 CSR 20-7.031(1)(N) to include reference to the digital geospatial dataset 'Losing Stream' developed by the Missouri Department of Natural Resources, Missouri Geological Survey. Reference to the digital geospatial dataset will provide the geospatial extent of losing streams as determined by the department. The static table for 'Losing Streams' at Table J of 10 CSR 20-7.031 will be removed from the rule in favor of the more current digital geospatial information in reference. Metadata on the digital geospatial dataset can be found at the following link – http://dnr.mo.gov/gis/WATER.LOSING_STREAM.xml

h. Remove Table K, Site-Specific Criteria

The proposed revision removes Table K, Site-Specific Criteria and any reference to the table from 10 CSR 20-7.031. In its current form, Table K contains disapproved or expired site-specific criteria for dissolved oxygen. Site-specific criteria for East Fork Locust Creek and Little East Fork Locust Creek in Sullivan County were disapproved by EPA on August 16, 2011. Site-specific criteria for Pike Creek and Main Ditch in Butler County were disapproved by EPA on May 10, 2013. Site-specific dissolved oxygen criteria for Sni-a-Bar Creek in Jackson County expired October 31, 2014 and are no longer applicable in rule. Revised criteria based on sound scientific rationale that protects the applicable designated aquatic habitat protection use have not been developed. As a result, the department is withdrawing the disapproved or expired site-specific criteria for dissolved oxygen from rule.

i. Missouri Use Designation Dataset Update

The Missouri Use Designation Dataset (MUDD) was first adopted on November 6, 2013. This MUDD update contains revisions that use more accurate GIS data to refine the delineation of start and end points of water body features, update and incorporate water body features according to 10 CSR 20-7.031(2), and recalculate stream mileages and lake acreages. Data and information contained in the 1:100,000 and 1:24,000 National Hydrography Dataset (NHD), Missouri's Aquatic Gap project, and supplemental information such as Digital Orthophoto

Quarter Quads (DOQQs), other high resolution imagery and maps, and information contained in permit applications or other sources were used for these revisions.

j. Section 304(a) Water Quality Criteria

Additions and/or revisions to specific ambient water quality criteria are recommended based on a review of EPA national criteria developed pursuant to Section 304(a) of the federal Clean Water Act. These modifications would bring Missouri's water quality standards up-to-date with many of the latest EPA national recommended water quality criteria. Water quality criteria updates for aluminum, manganese, ammonia, and bacteria/pathogens will be deferred to the next rulemaking due to staff and/or data limitations. Changes in the layout and format of the existing water quality criteria table (Table A) are needed in order to accommodate the Section 304(a) criteria revisions. Additional revisions are also needed to 10 CSR 20-7.031(5)(M) to incorporate default values for risk-based calculations used in development of Section 304(a) criteria for the protection of human health.

k. Numeric Nutrient Criteria for Lakes

In August 2011, the United States Environmental Protection Agency (EPA) disapproved the majority of Missouri’s numeric nutrient criteria (NNC) for lakes at 10 CSR 20-7.031(3)(N), citing concerns in regard to scientific rigor, reproducibility, and connection to designated uses (US EPA, 2011). The Missouri Department of Natural Resources, with the input of stakeholders, is proposing revised NNC for lakes and providing improved scientific rationale for criteria development while strengthening the link between the criteria and the designated uses of lake waters. It was decided through the Water Protection Forum that aquatic habitat protection and drinking water supply designated uses would be the focus of the current NNC effort. NNC for recreational uses will be pursued during a future rulemaking, likely within the 5 – 10 year timeframe, as studies and science for recreational uses become better established.

The proposed water quality standards rule includes numeric chlorophyll-a (Chl-a) criteria for lakes based on location. These criteria will apply to all lakes assigned designated uses in the Missouri Use Designation Dataset, with the exception of lakes located in the big river floodplains. Criteria for these lakes, as well as rivers and streams, will be addressed in a future rulemaking.

l. Water Quality Standards Variances

The proposed rule contains revisions to add clarification to the existing, approved variance language regarding state and federal variance procedures, and to incorporate by reference Missouri’s Multiple-Discharger Variance framework.

m. Miscellaneous Text Revisions

The proposed rule contains several revisions to update internal references, correct typographical errors, and improve the formatting of the rule. These revisions were discovered and compiled after the effective date of the last revisions to the water quality standards on February 28, 2014.

2. A report on the peer-reviewed scientific data used to commence the rulemaking process.

It is the policy and practice of the department to use peer-reviewed, sound science and scientific data for rulemaking. To the extent that scientific data and research are available to reference, those sources have been reviewed and included for each proposed revision:

a. Waters of the State Definition

The proposed rule revises the definition of "Waters of the state" in Missouri's water quality standards regulation [10 CSR 20-7.031(1)(DD)] to make the definition consistent with state statute [RSMo 644.016(27)]. The rule revision was derived from the electronic version of Missouri Revised Statutes, Chapter 644, Section 16 dated August 28, 2015 at the following link - http://www.moga.mo.gov/mostatutes/stathtml/64400000161.html. No additional peer-reviewed scientific information or data were used to make the revision.

b. Mixing Zones and Zones of Initial Dilution

The proposed rule clarifies the physical dimensions and requirements for mixing zones and zones of initial dilution. Federal regulation at 40 CFR 131.13 provides that "States may, at their discretion, include in their State standards, policies generally affecting their application and implementation, such as mixing zones, low flows and variances. Such policies are subject to EPA review and approval." EPA's *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991) states that "a mixing zone is an area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient water body. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented."

The revision updates the rule at 10 CSR 20-7.031(5)(A)4.B.(III) to allow site-specific mixing zone determinations at stream flows greater than 20 cubic feet per second. This provision is provided in rule for lower stream flows (i.e., 0.1 – 20 cubic feet per second) and extension to stream flows higher than 20 cubic feet per second is reasonable. Revisions to the mixing zone provisions at 10 CSR 20-7.031(5)(A)4.E. help to clarify these permitted areas must be free of organisms sensitive to the pollutants being discharged. Mixing zones and zones of initial dilution must allow zones of passage for aquatic organisms and be free of sensitive, rare or endangered species in the area that may be adversely impacted by the pollutant being discharged and covered by permit.

c. Hardness

Prior to the water quality standards rule effective March 30, 1994, the water hardness definition and calculation methodology specified that hardness would be determined by the "arithmetic average of a representative number of samples from the water body in question or from a similar water body". In 1994, the hardness definition and calculation methodology was revised to specify (as in the current rule) that a lower quartile (twenty-fifth percentile) would be used. Historical records for the rulemaking do not provide an explicit rationale for why the change was made. Conversations with current and former staff involved in water quality standards rulemaking reveal that the lower quartile approach was used to represent reference conditions and to reduce the bioavailability of toxics (e.g., metals) that compete for receptors within aquatic organisms.

A survey was conducted of other state water quality standards regulations to determine how other states define and calculate hardness in rule. Border states to Missouri as well as six other states were included in the survey. Most states are silent in their water quality standards regulations on how hardness values are determined, leaving the methodology to permit writer and assessment guidance documents. Those states that explicitly mention hardness in regulation use either a mean of the hardness values or the hardness as directly measured in the water body itself. Revising Missouri's hardness definition and calculation methodology to a median or fiftieth percentile value would bring Missouri's calculation methodology more in line with other states.

d. pH

The applicable pH criteria found in the current water quality standards rule (6.5 to 9.0 standard pH units) has remained unchanged since 1977. Curiously, however, the regulation does not contain information or detail regarding the duration or frequency of the criteria. Details in EPA's "Quality Criteria for Water, 1976" (aka "Red Book") indicate that pH levels within the range of 6.5 to 9.0 appear to "provide adequate protection for the life of freshwater fish and bottom dwelling invertebrate fish food organisms." Outside of this range, the "Red Book" indicates that fish "suffer adverse physiological effects increasing in severity as the degree of deviation increases until lethal levels are reached." The description of pH toxicity in EPA's criteria document suggests that values within the pH range are protective against chronic effects, while deviations outside the range may lead to acutely toxic or lethal conditions.

A survey was conducted of other state water quality standards to determine how pH criteria are expressed in those states. While no one state specified that their respective pH criteria were chronic in nature, many had prohibitions against acute pH swings of one hour duration. The results of the survey imply that most state pH criteria are chronic (four-day), rather than acute (one-day) in duration. As a result of the survey, and following consultation with stakeholders, the pH criteria in rule will be updated to clarify that it is a chronic criteria of four-day average duration.

e. General Criteria Revisions

General criteria are narrative standards and state that all waters shall be free from substances and conditions that are harmful to human, animal or aquatic life. The standards also state that there shall be "no toxics in toxic amounts," which provides the regulatory basis for establishment and enforcement of Whole Effluent Toxicity (WET) limitations in discharge permits. The narrative criteria apply to all designated uses at all flows and are necessary to meet the statutory requirements of Section 303(c)(2)(A) of the Clean Water Act.

The proposed rule revision at 10 CSR 20-7.031(4)(D) recognizes that chronically toxic conditions may exist in mixing zones where authorized by permit and acutely toxic conditions may exist in zones of initial dilution where authorized by permit. This clarification of current practice and understanding of toxicity requirements was requested by stakeholders. No peer-reviewed scientific data or information was necessary to commence this clarifying revision to the general criteria.

The proposed addition to the general criteria at 10 CSR 20-7.031(4)(E) provides a narrative statement in the water quality standards specific to the prevention of impacts due to nutrient enrichment. Similar statements directed toward the prevention of toxicity to aquatic life and human health are included in the general criteria and this statement clarifies the general criteria's applicability to nutrients. Support for a narrative criteria approach toward control of nutrients was expressed by stakeholders during the development of numeric nutrient criteria for lakes and reservoirs.

The proposed addition to the general criteria at 10 CSR 20-7.031(4)(F) was prompted by existing requirements in federal regulation at 40 CFR 131.10(b) to protect downstream uses. To assist states with developing downstream use protections in their water quality standards, EPA developed "Frequently Asked Questions" regarding protection of downstream water quality (EPA-802-F-14-001, June 2014) and a template (EPA 820-F-14-002) to assist states to develop narrative downstream protection criteria. Both of these guidance documents were reviewed and considered in drafting the general criteria language for protection of downstream uses at 10 CSR 20-7.031(4)(F).

f. Antidegradation Implementation Procedure

This revision updates reference to Missouri's Antidegradation Implementation Procedure in rule. No additional peer-reviewed scientific data was necessary to update reference to revisions to the revised AIP approved by the Missouri Clean Water Commission on July 13, 2016.

g. Losing Stream Reference and Table J

This revision removes an outdated table of losing streams at 10 CSR 20-7.031, Table J and replaces the static table with reference to the digital geospatial database 'Losing Stream' published by the Missouri Department of Natural Resources, Missouri Geological Survey. The Missouri Geological Survey conducts geologic and hydrologic evaluations of stream segments to determine the extent and location of losing stream reaches. The GIS information and data used to revise losing stream segment delineation and mileages in the digital geospatial dataset are peer-reviewed prior to publication and distribution. Regarding the proposed revision to 10 CSR 20-7.031, no additional peer-reviewed scientific data was necessary to remove an outdated table from regulation and replace it with reference to up-to-date digital geospatial information.

h. Remove Table K, Site-Specific Criteria

State developed site-specific criteria must be based on sound scientific rationale and protect applicable designated uses per 40 CFR 131.11(a)(1). Because the department has not developed revised site-specific dissolved oxygen criteria in response to EPA's disapproval or the expired criteria, removing Table K regulation will provide clarity that these criteria are no longer applicable for clean water act purposes. No additional peer-reviewed scientific information or data were used to make the revision.

i. Missouri Use Designation Dataset Update

These revisions involve the use of GIS information and data to clarify or correct water body segment identifications within the WQS. The GIS information and data used to revise water body segment delineation and mileages is peer-reviewed prior to publication and distribution. These data are housed on the department's GIS server and must have complete metadata and supporting documentation of data quality in order to be posted. External data downloaded from the Missouri Spatial Data Information Service (MSDIS) at http://msdis.missouri.edu/ must meet similar standards for use. No additional scientific analyses or data were used in making these revisions.

j. Section 304(a) Water Quality Criteria

Recommended revisions to federally developed Section 304(a) criteria are supported by peer-reviewed science, information and studies. Aquatic life protection criteria for toxic pollutants are the highest concentration of specific pollutants or parameters in water that are not expected to pose a significant risk to the majority of species. Human health protection criteria for specific pollutants or parameters reflect the latest science and information to ensure those pollutants do not pose a significant risk to human health when considering drinking water intake and fish consumption rates, health toxicity values, bioaccumulation factors, and relative source contributions. Documents that contain or reference supporting peer-reviewed science and information for individual pollutants are available at the links below by individual pollutant and designated use:

Aquatic Life Criteria – http://www2.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

Human Health Criteria – http://www2.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table

k. Numeric Nutrient Criteria for Lakes

The proposed rule has been developed consistent with federal rule 40 CFR 131.12, Section 304(a) of the Clean Water Act and EPA's published guidance. Decisions on specific criteria were based on analysis of data from over 200 lakes and reservoirs throughout the state. Dr. Jack Jones and his colleagues at the University of Missouri have been collecting nutrient and Chl-a data since 1976. The scope of designated uses to be considered by the revised numeric criteria was decided through a series of stakeholder discussions that were part of the department's Water Protection Forum. It was decided through this forum that the focus of revised numeric criteria development would concentrate on the aquatic habitat protection and drinking water supply designated uses, as sufficient data and information exist from which to establish criteria for these designated uses. Research and information continue to develop at the national level with respect to nutrient impacts and criteria for the protection of recreational uses.

A technical group was convened in May 2015 to reconcile conflicting claims on the level of criteria that would be sufficiently protective of designated uses but would also not trigger "false positives". False positives occur when measured nutrient or Chl-a levels exceed particular thresholds, but where there is no evident harm or impairment to designated uses. In order to minimize the occurrence of false positives while still protecting water quality, the group concluded that, rather than use direct criteria for total phosphorus (TP) and total nitrogen (TN), it would be more effective to establish numeric criteria for Chl-a (as a biological response to nutrient inputs) and to set numeric screening values for TP, TN and Chl-a in order to implement the criteria.

All three parameters are assigned long and short term screening values that vary with the general lake ecoregion. Long term screening values are based on at least three years' worth of data, and are more conservative than short term screening values, on which one years' worth of data can be assessed. Criteria for Chl-a are the same as the short term screening values. Compliance with Chl-a criteria is based on an assessment of at least three years' worth of data.

Lakes that have measured concentrations of TN, TP, or Chl-a that are greater than their respective short or long term screening values, but do not exceed Chl-a criteria, will be assessed for impairment using a weight of evidence evaluation. Factors to be examined for protection of aquatic habitat include the occurrence of fish kills, fluctuations in dissolved oxygen and pH levels, and mineral turbidity. For lakes that are sources of drinking water, additional factors include stresses on drinking water treatment plants and the occurrence of cyanotoxins and disinfection by-product formation as a result of harmful algae blooms.

A list of the peer-reviewed science and rationale used in the development of the proposed nutrient criteria for lakes can be found in criteria rationale document titled "Rationale for Missouri Numeric Nutrient Criteria for Lakes, September 2015" and supporting information on the department's Water Protection Forum, Water Quality Standards Workgroup web page.

l. Water Quality Standards Variances

The proposed rule contains revisions to add clarification to the existing, approved variance language regarding state and federal variance procedures, and to incorporate by reference Missouri's Multiple-Discharger Variance framework. EPA's November 17, 2015 decision letter partially approving and partially disapproving previously submitted variance language was used to draft the proposed revisions. No additional peer-reviewed scientific information or data were used to make the revision.

m. Miscellaneous Text Revisions

No scientific analyses or data were involved in the identification and correction of internal references, typographical errors or formatting issues.

3. <u>A description of the persons who will most likely be affected by the proposed rule, including persons that will bear the costs of the proposed rule and persons that will benefit from the proposed rule.</u>

Rulemaking and implementation of effective, approved rules affect persons both directly and indirectly. To the extent that information on persons that will bear the costs of the proposed rule and persons that will benefit from the proposed rule are available, those persons or groups of persons are listed and described for each proposed revision:

a. Waters of the State Definition

The proposed rule revision is in response to a change in state statute initiated by the general assembly to clarify state jurisdiction over surface and ground waters. The change clarifies waters of the state as those under the jurisdiction of the state of Missouri as defined in the definition and does not include waters of the united states within or adjacent to the state. The responsibility to define Waters of the United States (WOTUS) is the purview of the federal government, with the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers the lead agencies. Individual states are free to define what constitutes waters of the state and can incorporate WOTUS into their definitions, but it is not a requirement. In the event states do not incorporate WOTUS into their definition of waters of the state, delegated states must still implement the requirement of Section 101(a) of the federal Clean Water Act to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Removing language inclusive of WOTUS from state statute and definitions provides some additional clarity, but does not eliminate the department's responsibility to protect those waters. Removing language inclusive of WOTUS from the definition of waters of the state in statute and definition will not change how the department implements state and federal clean water law.

Persons affected by the proposed rule include those that may use waters of the state for agricultural, industrial, transportation or recreational purposes. However, requirements for waters of the state under the new definition will not differ from the current, effective rule as the department's implementation of state clean water law remains unchanged. Additional clarity on the jurisdiction and responsibility of the state with regard to its waters is an added benefit.

b. Mixing Zones and Zones of Initial Dilution

The proposed rule will directly affect the effluent limitations of permitted discharges to streams and rivers with a seven (7)-day Q_{10} low-flow (i.e., 7Q10) greater than 20 cubic feet per second. The provision will allow site-specific mixing zone determinations that may result in a recalculation of water quality based effluent limits, which most likely will become less stringent. The possibility also exists that some facilities may show no "reasonable potential" to exceed in-stream water quality standards and effluent limitations can be removed. Based on the results of the recalculation and depending on the type of treatment and discharge, changes in treatment may not be necessary to protect the receiving stream. The number of facilities that currently discharge to a stream with 7Q10 flow greater than 20 cubic feet per second is generally estimated as those facilities discharging directly into either the Missouri or Mississippi Rivers. Major and minor dischargers of domestic and industrial wastewater comprise the 102 facilities that discharge to the Missouri River and 80 facilities that discharge to the Mississippi River. These numbers provide a rough estimate of the number and type of facilities that may find relief, if site-specific mixing zone studies are conducted. Because the number of facilities that may take advantage of site-specific mixing zone determinations is not known, the cost savings in treatment technology upgrades versus the cost of site-specific mixing zone studies cannot be accurately estimated. In general, however, those facilities that elect to conduct site-specific mixing zone studies should find some degree of regulatory or economic relief.

Clarification in the requirements for mixing zones and zones of initial dilution will directly affect those facilities authorized by permit to have these areas of dilution. However, the clarifications do not add additional requirements for these permittees or the department. Rather, the clarifications formalize the requirements for zones of passage and sensitive species already found in regulation and conducted in practice.

c. Hardness

Facilities that have effluent limitations for hardness dependent metals will likely be affected by the proposed rule revision. These criteria require that a representative hardness value be calculated for the water body of concern in order to derive waste load allocations and water quality-based effluent limitations protective of water quality standards. The change in hardness value derivation from a twenty-fifth percentile to a median value should not affect the data quality and quantity objectives for these calculations or dischargers that may collect these data. Effluent limitations calculated as a result of revised hardness calculations will generally be less stringent than those calculated using the current methodology. Existing effluent limitations that use hardness in their derivation would not be impacted positively or negatively due to anti-backsliding provisions found in Section 402(o)(2)(B)(i) of the federal Clean Water Act. The Department would not be impacted positively or negatively as a result of the revisions since these calculations are required by the permit review and revision process.

d. pH

Section 304(a)(4) of the federal Clean Water Act defines pH as one of four "conventional pollutants" that must be regulated under Section 402 of the Act. Discharges of domestic wastewater are typically held to "secondary treatment" standards as defined at 304(d)(1) of the Act and in regulation at 40 CFR 133.102. Federal and state effluent regulations require pH to be in a range between 6.0 – 9.0 standard pH units. Discharges to waters with limited or no assimilative capacity (i.e., 7Q10 < 0.1 cubic feet per second) may find it difficult to meet in-stream water quality standards if the pH criteria are expressed as an acute, instantaneous minimum. Clarifying that the pH water quality criteria are expressed as four-day average, chronic conditions should allow for greater compliance with applicable water quality standards with limited to no impact on the health and diversity of aquatic ecosystems. No additional costs are expected to be incurred or borne by facilities with pH effluent limitations. To the contrary, those facilities that discharge to streams with limited to no assimilative capacity may find relief through a reduction of chemical addition (mainly alkalinity) and the costs associated with noncompliance and notices of violation to meet instantaneous minima.

e. General Criteria Revisions

The general criteria revisions at 10 CSR 20-7.031(4)(D) clarify that chronically toxic conditions may exist in mixing zones and acutely toxic conditions may exist in zones of initial dilution where authorized by permit. Facilities that discharge toxic pollutants to waters of the state, and those that utilize mixing zones or zones of initial dilution, will receive the benefit of clarity as to the toxicity conditions that may be authorized by their permit. No additional costs are anticipated for these facilities.

The addition of general criteria for the prevention of impacts to water quality as a result of nutrient enrichment will provide explicit protection in regulation from the deleterious effects of excess nutrients in the aquatic environment. The new narrative statement clarifies the existing narrative criteria and provides language specifying protections already in practice under the current rule. Facilities that discharge nutrients to waters of the state may be affected if those facilities discharge nutrients in quantities sufficient to cause harmful algal blooms, high turbidity, offensive odor, reduced aquatic biodiversity or prevent full maintenance of beneficial sues. However, the addition of the new narrative statement clarifies and refines existing narrative criteria (e.g., 10 CSR 20-7.031(4)(A) and (C)) and no additional or new costs are anticipated for these facilities. The clarification of narrative criteria for the prevention of nutrient impacts will provide clarity in regulation that the narrative criteria apply to nutrients. The application of narrative criteria to nutrients is understood and supported by stakeholders, and would have the benefit of creating clear goals and expectations for waters of the state consistent with Missouri's Nutrient Reduction Strategy.

The addition of general criteria for the protection of downstream uses at 10 CSR 20-7.031(4)(F) will provide consistency with the requirements of 40 CFR 131.10(b) in Missouri's water quality standards regulation. The department and EPA interprets the term "downstream" to include both intra- and interstate waters, as well as waters that form a boundary between adjacent jurisdictions. Local, state and federal governments, regulatory and resource management agencies, agricultural, industrial, municipal and environmental stakeholders, and the general public may be affected by implementation of the narrative criteria protections on a site-specific basis. The narrative criteria protections provided by 10 CSR 20-7.031(4)(F) will ensure that downstream jurisdictions, programs, agencies and stakeholders will be considered during water quality standards development and implementation. The narrative criteria revisions will also ensure that priority areas of concern, such as impaired waters, waters with significant economic or social importance, or waters with special designations or protections are considered during these activities.

f. Antidegradation Implementation Procedure

The revision updates reference to Missouri's Antidegradation Implementation Procedure (AIP) in rule and incorporates by reference the version adopted by the Missouri Clean Water Commission on July 13, 2016. No Clean Water Act actions (permit, enforcement or otherwise) have occurred that may be affected by this revision.

g. Losing Stream Reference and Table J

The revision removes an outdated reference table of losing streams and replaces the static table with reference to a digital geospatial dataset. The proposed rule revision will ensure that permits and water quality assessments are supported by accurate, up-to-date losing stream information through use of peer-reviewed digital geospatial data. Increased locational accuracy of losing streams reduces the potential for mistakes in the identification of applicable WQS and, consequently, for these errors to result in inappropriate permit limits and conditions or inaccurate water quality assessments. Avoiding these mistakes will save both time and resources for permit applicants and the department when preparing and reviewing permit applications.

h. Remove Table K, Site-Specific Criteria

Federal regulation at 40 CFR 131.21 governs the review and approval of state water quality standards by EPA. Water quality standards adopted by states after May 30, 2000 may not be used for clean water act purposes (i.e., permitting, enforcement, assessment, etc.) until EPA approved those water quality standards. The site-specific dissolved oxygen criteria found in Table K were all adopted following May 30, 2000 and were awaiting approval by EPA prior to revising permits affected by the criteria. Facilities affected by the disapproved or expired criteria are the City of Milan and Premium Standard Farms (East Fork Locust Creek, Little East Fork Locust Creek), the City of Blue Springs (Sni-a-Bar Creek), and the City of Poplar Bluff (Pike Creek and Main Ditch). Because the site-specific criteria in state regulation for these facilities were disapproved or have expired, the facilities are subject to the minimum 5.0 mg/L dissolved oxygen criteria effective in state regulation.

i. Missouri Use Designation Dataset Update

The proposed rule revisions will ensure that permits and water quality assessments are supported by an accurate water body segment delineation system. Increased locational accuracy of water body segments reduces the potential for mistakes in the identification of applicable WQS and, consequently, for these errors to result in inappropriate permit limits and conditions or inaccurate water quality assessments. Avoiding these mistakes will save both time and resources for permit applicants and the department when preparing and reviewing permit applications.

j. Section 304(a) Water Quality Criteria

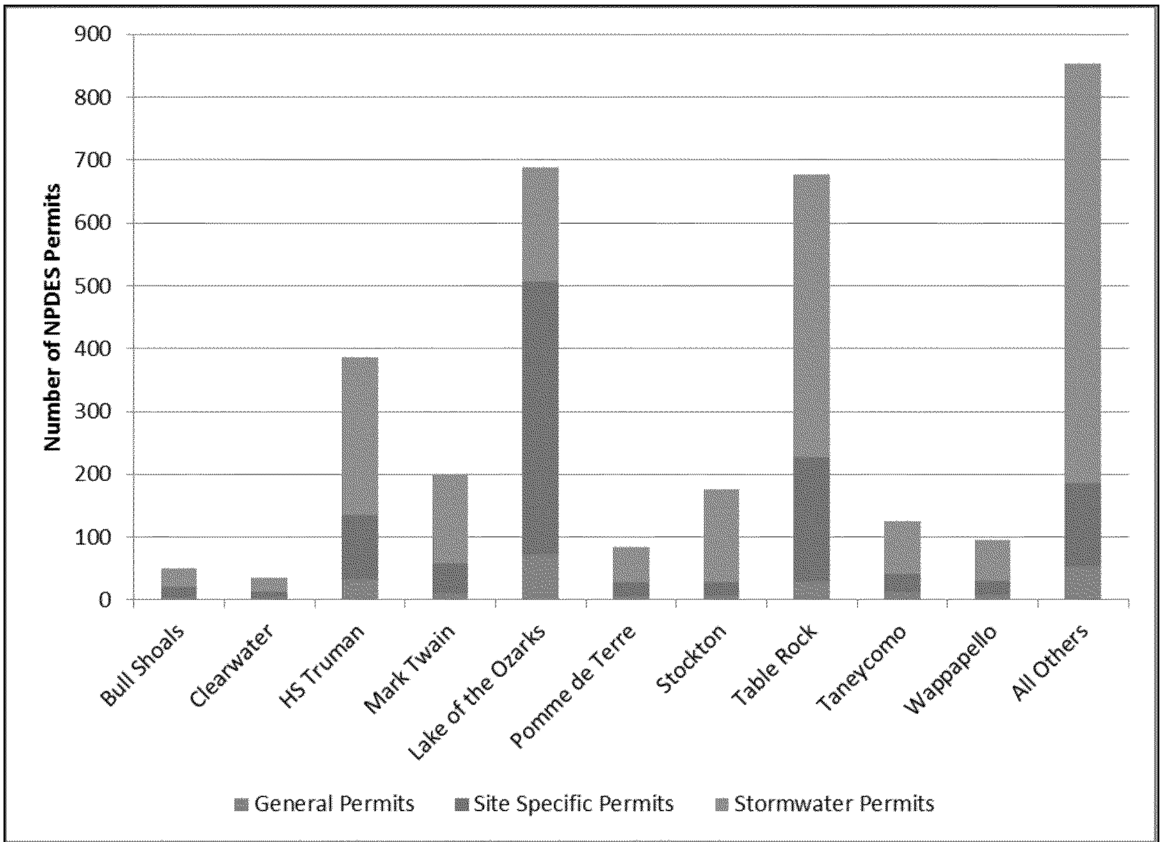
The new and revised Section 304(a) numeric water quality criteria being proposed were developed and promulgated at the federal level. This action seeks to make Missouri's water quality standards equivalent to federal standards per 40 CFR 131.

Facilities that treat wastewater containing the Section 304(a) numeric water quality criteria being added or revised may be affected by the proposed changes. A summary of the number of facilities having permitted effluent limits for the pollutants being added or revised can be found in Appendix A, Table 1. The effect of the proposed rule on each facility depends on the type of treatment system, the levels of the pollutant in the wastewater and in the receiving stream, and the applicability of anti-backsliding requirements. Because these factors are unique to each facility, the department is unable to determine from this list the precise extent of impact from the proposed changes. However, general impacts on these facilities, either positively through an increased limit or negatively through a decreased limit, can estimated based on the available data and current effluent limitations.

k. Numeric Nutrient Criteria for Lakes

Persons Affected - Point Sources:
There are more than 3,000 facilities with Missouri State Operating Permits producing a nutrient load from wastewater that are located within the watersheds of lakes and reservoirs assigned designated uses in the Missouri Use Designation Dataset. Of these permitted facilities, more than 2,000 hold some type of storm water permit. More than half of these are land disturbance permits, which are generally temporary and short-term. Site-specific permits account for a little over 1,000 of these facilities and there are 228 general permits. Roughly 75 percent of these facilities are within the watersheds of the ten largest reservoirs in the state (Figure 3.1).

Figure 3.1 Distribution of permitted wastewater facilities within lake watersheds.



Nutrients are a common pollutant in domestic wastewater. At present, there are 233 publicly owned treatment works (POTW) and 814 privately owned facilities that may be affected by the rule, including over 500 that serve residential units and subdivisions. Of these public and private facilities, 435 are within the Lake of the Ozarks watershed, and 199 are in the Table Rock Lake watershed. Other facilities discharging domestic wastewater that may be affected by the rule include 51 mobile home parks, 41 campgrounds, 35 motels, 15 restaurants, and 27 schools.

The probability of any of these facilities receiving new limits for nutrients will depend on whether the facility is within the watershed of a lake that is listed as impaired for nutrients, and the distance between the facility outfall and the receiving lake.

Persons Affected - Nonpoint Sources:
The most widespread nonpoint source contributor to nutrient loading of lakes and reservoirs is row-crop agriculture. Row cropping occurs primarily in the glaciated and Osage plains regions of the state. Processes of nutrient loading include overland flow and soil erosion. Other forms of agriculture, particularly livestock production, are also contributors. Nonpoint source contribution may be controlled through incentive programs that promote Best Management Practices (BMP) and environmental awareness. The U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS), the U.S. Environmental Protection Agency, and the

department's Soil and Water Conservation Program (SWCP) are the major sponsors of these efforts.

The State Soil and Water Conservation Cost-Share Program has seven resource concern areas for which funding is available: Nutrient and Pest Management; Grazing Management; Irrigation Management; Animal Waste Management; Sensitive Areas; Sheet, Rill and Gully Erosion; and Woodland Erosion, with 50 different conservation practices within these categories. These conservation practices are available to landowners for voluntary adoption to reduce soil erosion and protect or improve water quality. The program is administered locally in all 114 Missouri counties through soil and water conservation districts. The NRCS and Missouri Department of Conservation are technical partners with the program. In addition to supporting the State Soil and Water Conservation Cost-Share Program, the partners are engaged in many joint projects which leverage federal and state dollars, most recently the Mississippi River Basin Healthy Watersheds Initiative (MRBI) and the Regional Conservation Partnership Program (RCPP). For lakes and reservoirs that are in noncompliance with the rule, coordination with these agencies will be essential to addressing the problem. Implementation will, in many cases, be a long-term process. The benefits to lake and reservoir watersheds from these programs should gradually decrease nutrient, chemical, bacterial and sediment impacts.

The other principle source of nonpoint source nutrient loading is urban storm water runoff, which may contain significant amounts of nutrients from fertilizers. As with agriculture, runoff from certain urban activities is not regulated except in metropolitan municipalities covered by municipal separate storm sewer system (MS4) permits. There are 152 municipalities in Missouri that are required to manage their storm water runoff under Phase II of the National Pollutant Discharge Elimination System (NPDES). Educational and outreach programs work to improve lawn care management and reduce nutrient loading.

Persons Benefited:
In direct economic terms, the greatest beneficiaries from the proposed rule may be owners of lake front property. Several studies have indicated that increased water clarity associated with nutrient reduction is a significant factor in raising the value of such property. (Michael et al., 1996; Wilson and Carpenter 1999). Steinnes (1992), found an average increased value of $235 per lakeshore lot for each 1 meter increase in water transparency as measured with a Secchi disk. Conversely, numerous studies have demonstrated that the reduced water clarity associated with excessive nutrient loading have resulted in a wide range of losses of home values (U.S. EPA, 2015). Krysel et al. (2003) analyzed more than 1,200 lakeshore property sales in northern Minnesota that occurred between 1996 and 2001. Water clarity was a significant explanatory variable for lakeshore property prices. A loss of 1 m in Secchi depth could result in losses of up to $80,000 sales value in an individual lot. Kashian and Kasper (2010) found a decrease of $128 to $402 in the value per shoreline foot in Wisconsin lakes that had high algae blooms, when compared with nearby lakes that did not have this problem.

Other economic beneficiaries include businesses that are reliant on tourism-related lake recreation, such as restaurants, hotels, and marinas, as well as gas stations both near to and on the way to or from resort areas. Several studies demonstrated relationships between lake water clarity and levels of tourist recreation (Bouwes and Schneider, 1979; Ribaudo and Epp, 1984;

Smith et al., 1986; Wilson and Carpenter, 1999). Protected and enhanced water clarity will maintain and improve opportunities for whole body contact recreation. And, while some sport fishing potential is enhanced with higher nutrient loading, the potential for greater aquatic biodiversity tends to increase with reduced nutrient loading (Egertson and Downing, 2004).

Lastly, citizens that rely on certain public drinking water systems will also benefit. There are at least 42 communities that rely on 60 lakes as a source for drinking water supply (MDNR, 2015). Drinking water systems that use lakes as a source would experience fewer episodes of taste and odor problems that can occur as a consequence of excessive nutrient loading (MDNR, 2006). Furthermore, improved water quality in drinking water reservoirs would lead to a reduction in the cost of treating the water by reducing organic matter and other pollutants that require additional treatment.

l. Water Quality Standards Variances

The proposed rule contains revisions to add clarification to the existing, approved variance language regarding state and federal variance procedures, and to incorporate by reference Missouri's Multiple-Discharger Variance framework. These revisions and clarifications will generally benefit the state when granting variances, as well as individual permittees that may seek these variances. The Multiple-Discharger Variance framework is intended to cover minor municipal publicly-owned treatment works (POTW) within the state with a well-functioning lagoon technology that, if upgraded to meet the WQS for total ammonia nitrogen, would experience a substantial and widespread economic and social impact. The potential candidates who may benefit from implementation of this variance framework are listed in Appendix B of this document.

m. Miscellaneous Text Revisions

The internal reference inaccuracies, typographical errors and formatting issues could result in some misunderstanding of the standards. These rule revisions should prevent misunderstandings that could cause delays in decisions based on the sections of the rule affected by the errors.

4. A description of the environmental and economic costs and benefits of the proposed rule.

Implementation of effective, approved rules can have both environmental and economic costs and benefits. To the extent that costs and benefits of the proposed rule can be calculated and articulated, this report does so for each of the proposed revisions. Additional information and documents are referenced at the end of this report and may be found on the department's "Rules in Development" website at the following link: http://dnr.mo.gov/env/wpp/rules/wpp-rule-dev.htm

a. Waters of the State Definition

The fiscal note prepared to accompany HB 92 (No. 0070-01; February 19, 2015) provided information on the economic costs of the proposed legislation that is being implemented through the proposed revision. The proposed revision to the definition of waters of the state will not change how the department implements state and federal clean water law. As a result, no environmental and economic costs or benefits are anticipated as a result of the rule revision. Additionally, no fiscal impact is anticipated for state and local governments or small businesses as a result of the proposed revision and no direct fiscal impact was anticipated to other entities.

b. Mixing Zones and Zones of Initial Dilution

No significant economic or environmental costs are expected to result from the addition of site-specific mixing zone determination language to 10 CSR 20-7.031(5)(A)4.B.(III) or revisions to requirements at 10 CSR 20-7.031(5)(A)4.E. The use of site-specific mixing zone determinations is not a requirement and permitted facilities can elect to accept default mixing zone allowances in their permits. While site-specific mixing zone studies are allowed in practice, the revision will give facilities discharging to higher flow streams the option in rule to conduct mixing zones to gain better accuracy in the identification and delineation of their mixing zone. Permitted facilities will need to determine whether the benefit of the site-specific mixing study in regard to effluent limitations and potential treatment costs outweigh the cost of the study. No significant economic or environmental costs are expected for mixing zone and zone of initial dilution clarifications as zones of passage and avoidance of sensitive species are already considered and implemented in practice. No significant economic or environmental benefits are expected as the revisions clarify current practice that aquatic habitats and species are protected to the level necessary to support the aquatic ecosystem existing or attainable in the water body.

c. Hardness

The proposed rule change in the definition and derivation methodology for hardness is not expected to result in significant economic or environmental costs or benefits. No additional quality assurance/quality control measures will be required with the change and minimum sample amounts and frequency will not change. The department currently calculates hardness values for effluent limitations, water quality criteria development and water quality assessments. The change in statistical derivation will be neutral in terms of these processes. For permitted facilities that require hardness calculations, effluent limitations derived from the calculated value may be more or less stringent depending on the data set used in the derivation. Generally, however, any resulting effluent limitations will most likely be less stringent using a median hardness than a lower quartile value.

d. pH

The proposed revisions to clarify the pH criteria as four-day average, chronic criteria will provide some relief to permitted facilities that discharge to waters with limited or no assimilative capacity. As a result, no economic costs are expected and some economic benefit may actually occur as costs related to alkalinity addition to achieve compliance with an erroneous minimum would be reduced. The pH criteria range of 6.0 – 9.0 standard pH units is still within the range of criteria found in the EPA "Red Book" and environmental costs or benefits are not expected.

e. General Criteria Revisions

No significant economic or environmental costs are expected from the revision of the general criteria. The proposed general criteria revision to toxics will provide greater clarity for when and where chronic and acute toxic conditions may occur. The proposed addition of narrative criteria for the prevention and protection from the impacts of nutrient enrichment will clarify current practice and provide clear general criteria specific to nutrients. The proposed addition of narrative criteria for downstream use protection will codify current practice and fulfill a requirement of the federal clean water act to include such a provision in state water quality standards. Similarly, no economic or environmental benefit is to be expected as a result of the rule revisions. The proposed revisions are generally considered neutral to permitted facilities, but may provide a regulatory benefit from the clarity that the proposed revisions will bring.

f. Antidegradation Implementation Procedure

No environmental or economic costs or benefits are anticipated in updating reference in the WQS to the AIP approved by the Missouri Clean Water Commission on July 13, 2016. To date, no applicants or antidegradation reviews have occurred for bioaccumulative pollutants utilizing the *de minimis* provision found in previous versions of the AIP. Therefore, no costs will be incurred to revisit previously conducted antidegradation reviews.

g. Losing Stream Reference and Table J

Removing an outdated, static table of losing streams and replacing it with reference to up-to-date digital geospatial information will result in greater locational accuracy of losing stream segments in the state. This improved accuracy will increase the efficiency of program activities that may require the use of the losing stream information (e.g., permits and water quality assessments). The increased efficiency should reduce costs for both permit applicants and the department and result in more accurate determinations for permits and water quality assessments.

h. Remove Table K, Site-Specific Criteria

The revision to remove Table K from regulation is not expected to directly result in economic and environmental costs or benefits. The proposed revision removes disapproved or expired site-specific dissolved oxygen criteria that are currently not effective for clean water act purposes. Any current or future economic and environmental costs or benefits that may result from the removal of an outdated table from regulation are not known.

i. Missouri Use Designation Dataset Update

Original estimates for cost and benefits for the dataset were estimated in the Regulatory Impact Report dated November 9, 2012 for the rule effective February 28, 2014. These rule revisions will result in better accuracy in the identification of lakes and streams. This improved accuracy will increase the efficiency of program activities that require the use of the water body delineation information (e.g., permits, water quality assessments, and total maximum daily loads). The increased efficiency and accuracy of revisions should reduce costs for both permit applicants and the department.

j. Section 304(a) Water Quality Criteria

The proposed revisions to Section 304(a) criteria in rule are in response to changes in these criteria at the federal level to establish appropriate thresholds to prevent toxic effects on aquatic life and human health. An explanation of the basis for the changes in the federal criteria can be found in the supporting science and information referenced in section 2j. Missouri is adopting these federal criteria without modification and any environmental and economic costs and benefits are determined by the actions at the federal level and not the state. While Section 536, RSMo, does not require a cost and benefit analysis when federal requirements are adopted without modification, this RIR notes that 2,676 site-specific permits, 1,388 general permits, 774 storm water permits, and 3 underground injection permits might be affected by these revisions. Table 2 in Appendix A shows the number of permitted facilities having NPDES permits with limits for each federal 304(a) criteria proposed to be revised.

k. Numeric Nutrient Criteria for Lakes

The cost to control nutrient loading as a result of this rule varies considerably, depending on the current condition of lake water quality, the source of pollution (point or nonpoint source), and the types of additional nutrient management needed. The number of lakes in the Missouri Use Designation Dataset that are estimated to exceed the proposed criteria are summarized in Table 4.1.

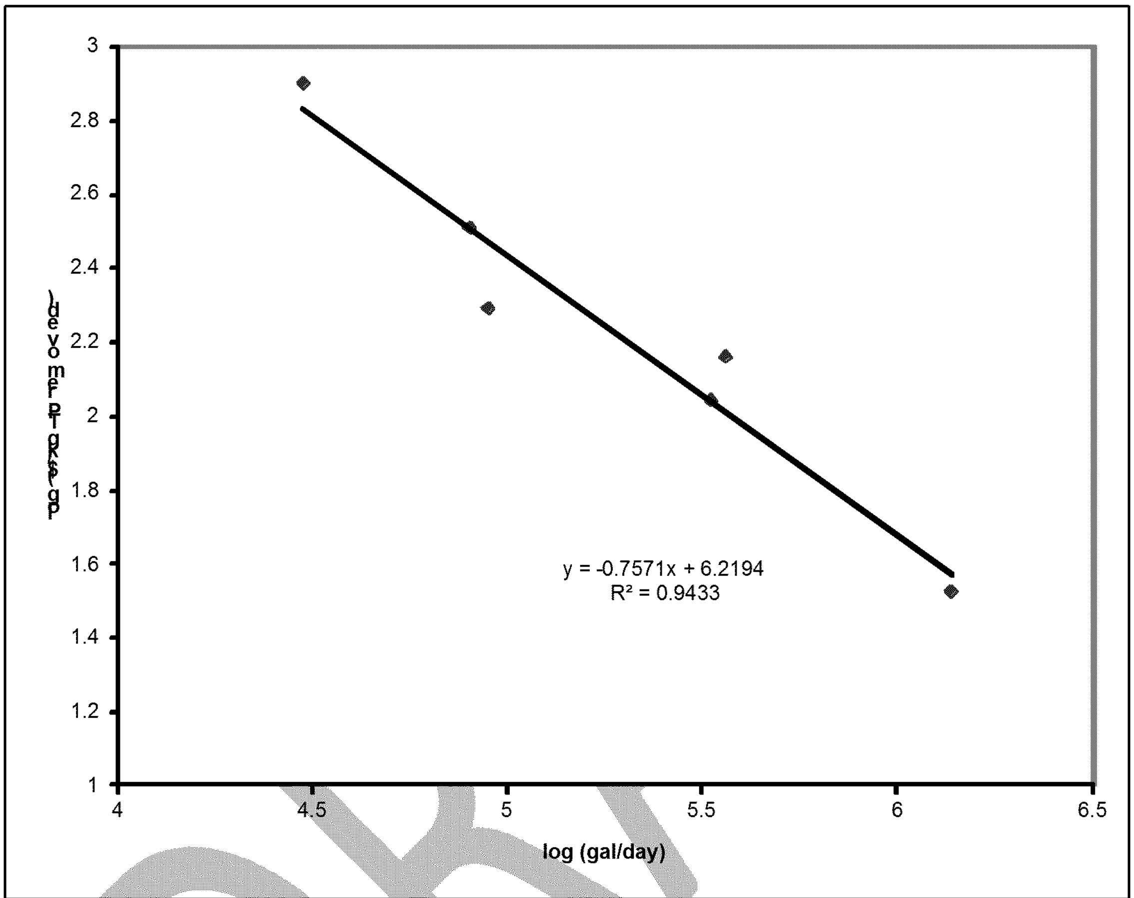
Table 4.1. Number of lakes that exceed proposed criteria and screening values

Lake Ecoregion	Number of Lakes that Exceed Chl-a Criteria	Number of Lakes that Exceed Screening Values for TP, TN, or Chl-a	Total Lakes for which Nutrient Data are Available
Plains (Drinking Water Supply Lakes)	12	45	67
Plains (Other Lakes)	6	33	85
Ozark Border	6	18	41
Ozark Highlands	6	13	48
Totals	30	109	241

<u>**Domestic Wastewater**</u>

Cost of phosphorus removal from point source discharges:
There are over 1,000 wastewater facilities that discharge within the watersheds of lakes greater than 10 acres. Of these wastewater facilities, 440 discharge toward the Lake of the Ozarks. The costs cited in the following analyses are based on the assumption that all the lakes counted in Table 4.5 will be placed on the 303(d) list of impaired waters for nutrients. If, for instance, the Lake of the Ozarks turns out not to be listed, anticipated costs will be reduced by a large margin. It may turn out that applying treatment for TP alone would be sufficient to mitigate the impairment, since TP is generally the most limiting nutrient to algae growth in lakes. The scenarios that follow are presented as alternative projections. Total Phosphorus (TP) removal from wastewater discharges has costs that are dependent on a number of factors, the most significant being the size of the facility. Generally, the larger the facility, the lower the cost per unit mass of phosphorus removed. A study of wastewater treatment plants (WWTP) in six small communities in Texas illustrates this point. Figure 4.1 is a log-transformed linear regression of the cost to remove a kilogram per day of TP from the effluent as it relates to quantity of WWTP discharge (Keplinger et al., 2004).

Figure 4.1. Cost of TP removal as a function of WWTP daily discharge in six communities in Texas (from Keplinger et al. 2004).



It is possible that any waste load allocations developed for nutrient-impaired lakes from the proposed nutrient response criteria for may be less restrictive for facilities that do not directly discharge to a lake. This is because of the potential for effective nutrient reduction through instream processes and uptake by riparian vegetation. For example, phosphorus can be bound by organic matter which can then settle in stream sediments. Denitrification, the transformation of nitrate to nitrogen gas, can effectively remove nitrogen from the aquatic environment.

Pending the outcome of a reasonable potential analysis, it is possible that some facilities, particularly smaller ones, may qualify for less stringent nutrient or Chl-a effluent limitations, or no limitations at all. Such an outcome may be contingent upon the size of the facility, the volume of discharge, and the proximity to the lake. About 72 percent of wastewater outfalls in the lake watersheds have design flows of less than 22,500 gallons per day (gpd) and 12 percent have design flows greater than 100,000 gpd. In addition to the discharge capacity of the facility and proximity to the lake in question, other factors affecting the cost of nutrient removal include the type of wastewater treatment system, whether nutrient removal is being adapted to an existing system or installed as a part of a new system, and the target nutrient concentration in the effluent.

Effluent rules at 10 CSR 20-7.015(3)(F) & (G) set an effluent limit of 0.5 mg/L total phosphorus as a monthly average and provide a schedule of compliance for facilities discharging in the Table Rock Lake and Lake Taneycomo watersheds. Facilities discharging one million gallons per day (1 MGD) or more complied with this rule by November 30, 2003. Some operators of small facilities (less than 1 MGD) have voluntarily installed phosphorus removal systems, out of concern that nutrient impairment of Table Rock Lake was affecting the resort business that they served.

Cost of nitrogen removal from point source discharges:
Biological Nutrient Removal (BNR) may be used to reduce total nitrogen in wastewater facilities. This technology has been implemented in the Chesapeake Bay area since 1983 and achieved total nitrogen limits of 8 mg/L and total phosphorus of 3 mg/L. Activated sludge enhanced nutrient removal systems achieved 3 mg/L and 0.3 mg/L of TN and TP, respectively. As recently as 25 years ago, reduction of total nitrogen in effluent to 8mg/L cost about $35 per pound of nitrogen removed. Currently, 2 mg/L is state of the art, and reductions to 3 mg/L are widely feasible. Costs are less than $10 per pound for facilities without nutrient reduction technology, and as low as $4 per pound for those plants with some treatment already in place (Chesapeake Bay Commission, 2004).

The cost of upgrading a facility for nitrogen removal is dependent on a number of factors, including size of the facility and type of treatment. For systems with design flows of less than 0.5 MGD, there are two options for retrofitting; the addition of an anoxic tank or a deep bed denitrification filter (EPA 2007). The anoxic tank option is applicable to systems that use the Modified Ludzack-Ettinger (MLE) process, which is not common in Missouri, and particularly not in smaller systems. However, deep bed denitrification filters can be added to package plants. For facilities with greater flows, there is a wider range of system upgrade options for nitrogen control. Systems already in use in Missouri include Anaerobic/anoxic/Aerobic Process (A^2/O), Activated Sludge, Methanol, Oxidation Ditch, Rotating Biological Contactor (RBC), and Sequencing Batch Reactor (SBR).

General Considerations:
The number and size of permitted facilities in Missouri that may be affected by the proposed numeric nutrient criteria are presented in Table 4.2. The costs for nutrient removal upgrades at these facilities are presented on the assumption that all lakes in the state will be listed as impaired and some level of treatment will be necessary. The weight of evidence methodology found in the proposed numeric nutrient criteria framework may reduce the number of impacted facilities further as more detailed, site-specific assessments may indicate designated uses are being met (i.e., not impaired). Actual facility upgrade costs are likely to be considerably lower than these estimates and implementation strategies such as optimization of facility performance and nutrient trading may delay, or eliminate, the need for upgrades.

Table 4.2. Wastewater facilities in lake watersheds statewide.

Design Flow (MGD)	Public	Private	Total
≤0.01	35	521	556
0.01-0.05	55	228	283
0.05-0.1	41	25	66
0.1-0.5	55	20	75
0.5-1	15	1	16
>1	24	3	27
Totals	225	798	1023

Table 4.2 excludes all of those facilities located in the watersheds of lakes listed in Table M of the regulation; it includes facilities within the Table Rock Lake watershed (including Beaver Reservoir, HUC-8 11010001, and James River, HUC-8 11010002). Estimates of costs for these excluded facilities were considered in the Regulatory Impact Report dated May 16, 2008 as part of the previous lake numeric nutrient criteria rulemaking effective October 30, 2009. Most facilities in the watersheds of Table Rock Lake and Lake Taneycomo are already required by regulation at 10 CSR 20-7.015(3)(E) and (F), respectively, to reduce total phosphorous in effluent to 0.5 mg/L. However, additional consideration is needed for nitrogen reduction (i.e., denitrificiation) as these costs may not have already been estimated. The distribution of facilities in the Table Rock Lake and Lake Taneycomo watersheds is described in Table 4.3.

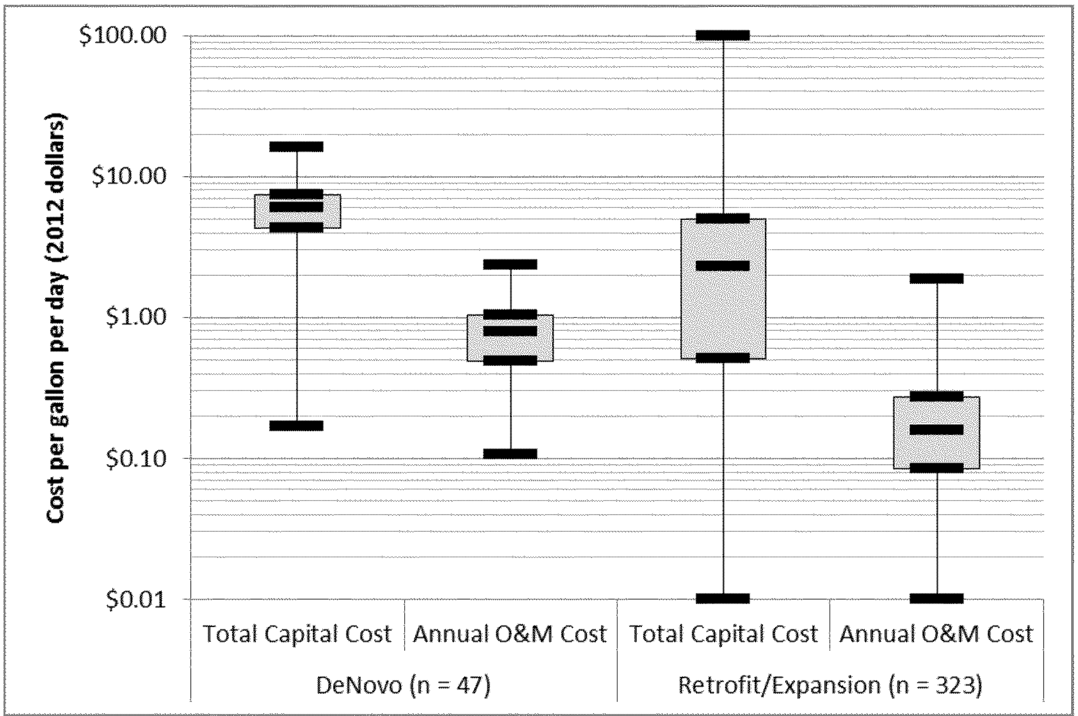
Table 4.3. Wastewater facilities in Table Rock Lake and Lake Taneycomo watersheds.

Design Flow (MGD)	Public	Private	Total
≤0.01	7	102	109
0.01-0.05	4	76	80
0.05-0.1	7	7	14
0.1-0.5	9	6	15
0.5-1	4	2	6
>1	7	3	10
Totals	38	196	234

There are numerous variables to consider when estimating the cost of upgrading facilities to achieve compliance with numeric nutrient criteria in lakes. Some facilities may already have some degree of nutrient control and may only need marginal upgrades or changes in operations to achieve compliance. Others may require more extensive improvements. For example, some facilities may be at or near the end of their planned operation life, and may require total or near total replacement for all systems, not just for nutrient removal. In any case, the department can take into consideration the optimal time to implement upgrades by working closely with the permit-holder to develop a reasonable and workable schedule of compliance.

EPA (2015a) compiled capital and operating costs for upgrading over 350 wastewater facilities nationwide to control TP and TN (as well as a number of facilities in Spain). These costs are summarized in Figure 4.2.

Figure 4.2: Interquartile range and total distribution of costs for facility upgrades



CAPDETS Analysis

An analysis of the estimated economic cost of implementing numeric nutrient criteria for lakes using the CAPDETS model was performed in support of this RIR. Assumptions used in the model are described below, with specific expense assumptions found in Appendix A, Table 3.

1) Capital Installation and Operation and Maintenance (O&M) costs were estimated from CAPDETWorks models developed by Tetra Tech. Total installation capital costs and annual O&M costs were developed for four scenarios representing widely available nutrient reduction technologies. Scenario descriptions for each nutrient reduction technology can be found below and tables representing the range of costs are contained in Tables 4.5 – 4.8.

   It is important to note that CAPDETWorks is mainly designed to assess systems with larger design flows (>0.1 MGD); estimates for smaller systems (≤ 0.1 MGD) are likely overstated. Since the overwhelming majority of treatment systems are smaller systems, it is expected that total cost estimates for each scenario are overstated, and that actual total costs may be considerably lower.

2) Operation and maintenance includes chemical input, repairs, and lab analyses.

3) Estimates do not account for specific waste load allocations required by TMDLs or other situations

4) Upgrade scenarios considered in the CAPDETWorks analysis are listed in Table 4.4.

Table 4.4: Facility upgrade scenarios

Upgrade Scenario #	Scenario Description	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
1	Addition of anoxic basin to existing aeration process without filtration	0.5	8
2	Addition of anoxic basin to existing aeration process with filtration	0.5	8
3	Addition of anoxic basin and chemical phosphorus removal to existing aeration process without filtration[1]	1	10
4	Addition of anoxic basin and chemical phosphorus removal to existing aeration process with filtration[2]	0.5	10

[1] Use of this scenario statewide includes application of Scenario 1 in the Table Rock Lake and Lake Taneycomo watersheds.
[2] Use pf this scenario statewide includes application of Scenario 2 in the Table Rock Lake and Lake Taneycomo watersheds.

Scenario 1: Existing extended aeration process adding anoxic basin without filtration.

Table 4.5a: Estimated total installation costs for affected facilities for implementation of Scenario 1.

Design Flow (MGD)	Public	Private	Totals	Annual Cost Based on 20-Year Amortization
<0.01	$38,150,000	$567,890,000	$606,040,000	$48,630,218
0.01-0.05	$63,800,000	$264,480,000	$328,280,000	$26,342,037
0.05-0.1	$54,120,000	$33,000,000	$87,120,000	$6,990,734
0.1-0.5	$91,630,000	$28,900,000	$120,530,000	$9,671,639
0.5-1	$39,090,000	$7,460,000	$46,550,000	$3,735,292
>1	$222,850,000	$25,740,000	$248,590,000	$19,947,505
Totals	$509,640,000	$927,470,000	$1,437,110,000	$115,347,425

Table 4.5b: Estimated total annual operation and maintenance costs for affected facilities for implementation of Scenario 1:

Design Flow (MGD)	Public	Private	Total O&M Cost	Total O&M plus Amortization Costs
<0.01	$4,095,000	$60,597,000	$65,052,000	$113,682,218
0.01-0.05	$6,435,000	$26,676,000	$33,111,000	$59,453,037
0.05-0.1	$4,961,000	$3,025,000	$7,986,000	$14,976,734
0.1-0.5	$7,942,000	$2,512,000	$10,454,000	$20,125,639
0.5-1	$3,264,000	$623,000	$3,887,000	$7,622,292
>1	$15,638,000	$1,834,000	$17,472,000	$37,419,505
Totals	$42,335,000	$95,627,000	$137,962,000	$253,279,425

Scenario 2: Existing extended aeration process adding anoxic basin with filtration.

Table 4.6a: Estimated total installation costs for affected facilities for implementation of Scenario 2.

Design Flow (MGD)	Public	Private	Totals	Annual Cost Based on 20-Year Amortization
<0.01	$51,100,000	$760,660,000	$811,760,000	$65,137,723
0.01-0.05	$99,000,000	$410,400,000	$509,400,000	$40,875,574
0.05-0.1	$86,920,000	$53,000,000	$139,920,000	$11,277,543
0.1-0.5	$152,500,000	$48,160,000	$200,660,000	$16,101,478
0.5-1	$58,960,000	$11,650,000	$70,610,000	$5,665,929
>1	$307,510,000	$35,480,000	$342,990,000	$27,522,404
Totals	$755,990,000	$1,319,350,000	$2,075,340,000	$166,530,650

Table 4.6b: Estimated total annual operation and maintenance costs for affected facilities for implementation of Scenario 2:

Design Flow (MGD)	Public	Private	Total O&M Cost	Total O&M plus Amortization Costs
<0.01	$4,480,000	$66,688,000	$71,168,000	$136,305,723
0.01-0.05	$7,095,000	$29,412,000	$36,507,000	$77,382,574
0.05-0.1	$5,863,000	$3,575,000	$9,438,000	$20,665,543
0.1-0.5	$9,630,000	$3,046,000	$12,676,000	$28,777,478
0.5-1	$3,765,000	$735,000	$4,500,000	$10,165,929
>1	$17,515,000	$2,048,000	$19,563,000	$47,085,404
Totals	$48,348,000	$107,170,000	$153,852,000	$320,382,650

Scenario 3: Existing extended aeration process adding anoxic basin with chemical phosphorus removal (Adding anoxic basin only in Table Rock Lake and Lake Taneycomo watersheds).

Table 4.7a: Estimated total installation costs for affected facilities for implementation of Scenario 3.

Design Flow (MGD)	Public	Private	Totals	Annual Cost Based on 20-Year Amortization
<0.01	$41,230,000	$613,980,000	$655,210,000	$52,575,746
0.01-0.05	$75,020,000	$297,920,000	$372,940,000	$29,925,670
0.05-0.1	$63,980,000	$38,510,000	$102,490,000	$8,224,063
0.1-0.5	$119,240,000	$35,600,000	$154,840,000	$12,424,762
0.5-1	$60,470,000	$8,530,000	$69,000,000	$5,536,739
>1	$336,800,000	$25,740,000	$362,540,000	$29,091,148
Totals	$696,740,000	$1,020,280,000	$1,717,020,000	$137,778,127

Table 4.7b: Estimated total annual operation and maintenance costs for affected facilities for implementation of Scenario 3:

Design Flow (MGD)	Public	Private	Total O&M Cost	Total O&M plus Amortization Costs
<0.01	$5,271,000	$78,555,000	$83,826,000	$136,401,746
0.01-0.05	$9,669,000	$36,404,000	$46,103,000	$76,028,670
0.05-0.1	$7,919,000	$4,678,000	$12,597,000	$20,821,063
0.1-0.5	$13,840,000	$3,983,000	$17,823,000	$30,247,762
0.5-1	$6,256,000	$804,000	$7,060,000	$12,596,739
>1	$25,979,000	$1,834,000	$27,813,000	$56,904,148
Totals	$68,964,000	$126,258,000	$195,222,000	$333,000,127

Scenario 4: Existing extended aeration process adding anoxic basin with filtration and phosphorus removal (Adding anoxic basin with filtration only in Table Rock Lake and Lake Taneycomo watersheds).

Table 4.8a: Estimated total installation costs for affected facilities for implementation of Scenario 4.

Design Flow (MGD)	Public	Private	Totals	Annual Cost Based on 20-Year Amortization
<0.01	$53,060,000	$789,990,000	$843,050,000	$67,648,513
0.01-0.05	$110,270,000	$443,840,000	$554,060,000	$44,459,208
0.05-0.1	$96,780,000	$58,510,000	$155,290,000	$12,460,871
0.1-0.5	$179,810,000	$54,770,000	$234,580,000	$18,823,306
0.5-1	$72,680,000	$12,760,000	$85,440,000	$6,855,927
>1	$376,420,000	$35,480,000	$411,900,000	$33,051,921
Totals	$888,970,000	$1,395,350,000	$2,284,320,000	$183,299,746

Table 4.8b: Estimated total annual operation and maintenance costs for affected facilities for implementation of Scenario 4:

Design Flow (MGD)	Public	Private	Total O&M Cost	Total O&M plus Amortization Costs
<0.01	$5,460,000	$81,353,000	$86,813,000	$154,461,513
0.01-0.05	$10,665,000	$40,052,000	$50,717,000	$95,176,208
0.05-0.1	$8,855,000	$5,247,000	$14,102,000	$26,562,871
0.1-0.5	$15,870,000	$4,529,000	$20,099,000	$38,922,306
0.5-1	$5,921,000	$915,000	$6,836,000	$13,691,927
>1	$24,380,000	$2,048,000	$26,428,000	$59,479,921
Totals	$70,851,000	$134,144,000	$204,995,000	$388,294,746

Fiscal Note Development

Summary tables representing the estimated highest and lowest total capital installation costs and total annual O&M costs are contained in Tables 4.9 and 4.10 for public and private facilities, respectively. Application of a *de minimis* threshold or other cost reduction strategies as detailed below may reduce these estimates of cost. Additional tables presenting public and private total installation and total annual O&M costs by watershed using 8-digit hydrologic unit codes can be found in Appendix C.

Table 4.9. Estimated CAPDET Costs for all Public Facilities in Lake Watersheds

Design Flow (DF) in MGD		Capital Costs	Annual O&M	Total
DF≤0.05	Low	$101,950,000	$10,530,000	$112,480,000
	High	$163,280,000	$16,125,000	$179,405,000
0.05<DF≤1	Low	$184,840,000	$16,167,000	$201,007,000
	High	$349,270,000	$30,346,000	$379,616,000
1<DF≤20	Low	$152,650,000	$11,288,000	$163,938,000
	High	$281,920,000	$19,500,000	$301,420,000
DF>20	Low	$70,200,000	$4,350,000	$74,550,000
	High	$94,500,000	$4,880,000	$99,380,000
Totals*	**Low**	**$509,640,000**	**$42,335,000**	**$551,975,000**
	High	**$888,970,000**	**$70,851,000**	**$959,821,000**

* Application of a *de minimis* threshold of 0.0225 MGD would reduce the number of public facilities affected (n = 173) and total CAPDET estimates to within the range of $488,021,000 – $863,868,000

Table 4.10. Estimated CAPDET Costs for all Private Facilities in Lake Watersheds

Design Flow (DF) in MGD		Capital Costs	Annual O&M	Total
DF≤0.05	Low	$832,370,000	$87,633,000	$920,003,000
	High	$1,233,830,000	$121,405,000	$1,355,235,000
0.05<DF≤1	Low	$69,360,000	$6,160,000	$75,520,000
	High	$126,040,000	$10,691,000	$136,731,000
1<DF≤20	Low	$25,740,000	$1,834,000	$27,574,000
	High	$35,480,000	$2,048,000	$37,528,000
DF>20	Low	$0	$0	$0
	High	$0	$0	$0
Totals**	**Low**	**$927,470,000**	**$95,627,000**	**$1,023,097,000**
	High	**$1,395,350,000**	**$134,144,000**	**$1,529,494,000**

** Application of a *de minimis* threshold of 0.0225 MGD would reduce the number of private facilities affected (n = 123) and total CAPDET estimates to within the range of $197,592,000 – $331,795,000

Range of Possible Treatment Costs

It should be noted that although the figures in Tables 4.9 and 4.10 represent significant potential public and private expenditures, some of these costs may be avoided by applying certain techniques in the management of wastewater facilities. For example, in some activated sludge facilities, cyclical reductions in aeration can accelerate denitrification, which, in addition to lowering the total nitrogen concentration in the effluent, reduces energy consumption. If applied prior to the activated sludge stage, reduced aeration can also support biological phosphorus removal. Lagoon systems can be managed for reduced nutrient discharge by restricting the release of effluent to warm season months, when absorption of nutrients by algae and bacteria within the lagoon is more active. More information on these methods can be found at US EPA (2015b).

In general, gains in efficiency of treatment through process improvements or modifications can result in reduction of capital costs, with perhaps minor or no change in costs for annual O&M. The estimated costs for implementation of the proposed numeric nutrient criteria, therefore, may be well within the lower (i.e., "Low") end of the range given in Tables 4.9 and 4.10.

Additionally, the proposed criteria have been developed using Missouri-based water quality data and methods to ensure that the unique nature of Missouri's man-made reservoirs is considered, and to prevent inaccurate assessment of waters as impaired based on overly conservative phosphorous or nitrogen values. In contrast, more stringent numeric nutrient criteria, such as the ecoregional values that are likely to be imposed by EPA[3] in the absence of state-developed criteria, are likely to result in impairment designations even when waters are meeting all designated uses. This may result in imposition of unnecessary treatment technologies, imposing a high cost for limited benefit. Consequently, EPA promulgated criteria are likely to result in costs toward the "high" end of the range estimates, and Missouri's proposed criteria are likely to result in costs toward the "low" end of the range estimates.

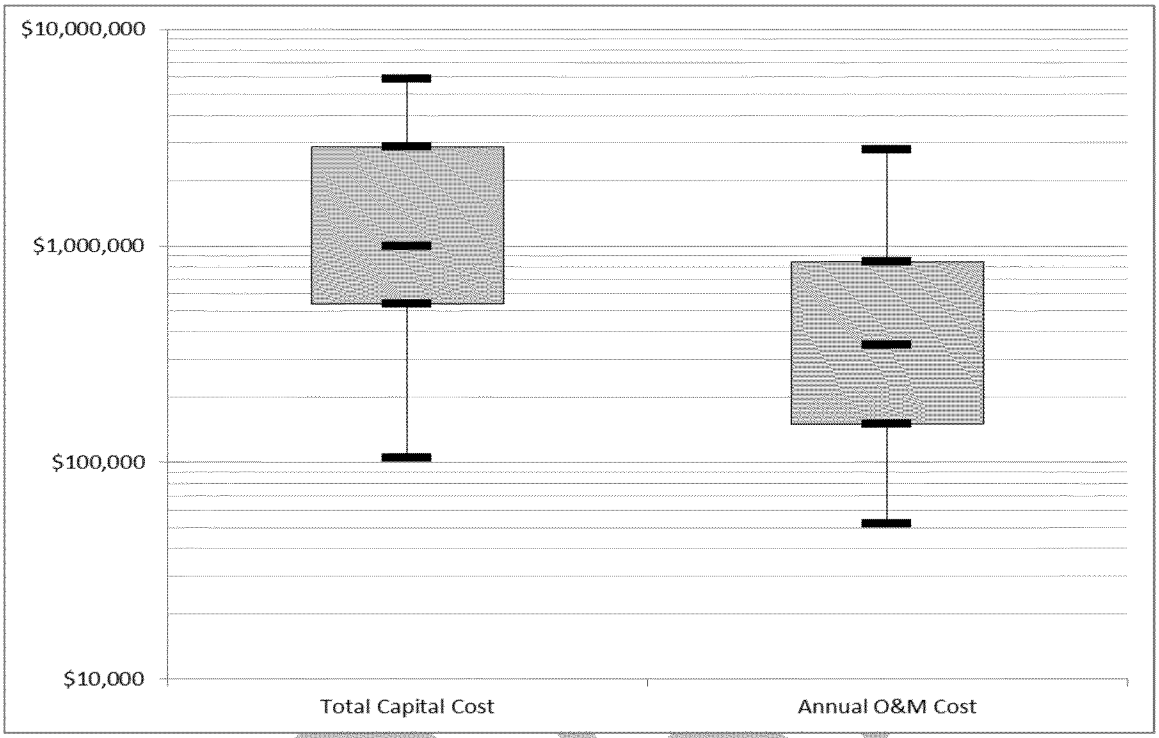
Industrial Wastewater

There are approximately 80 industrial facilities permitted to discharge wastewater in lake watersheds in Missouri. These include meat packers, other food processors, fish hatcheries, mines, and ore processors. The content of the effluent that they produce is highly variable, some of which has significant nutrient content, and some of which does not.

Available information on the costs of upgrading industrial wastewater facilities is limited. EPA (2015a) came up with figures from about 20 meat and poultry processors. Their capital costs ranged from approximately $500,000 to $6 million. Annual operation and maintenance costs ranged from $50,000 to nearly $3 million (Figure 4.4).

[3] The department originally promulgated numeric nutrient criteria for lakes in 2009. These criteria were disapproved in large part by EPA in 2011. The state tabled discussion on addressing the disapproval in preference for moving more quickly on its stream classification rulemaking, which concluded in 2014. The state renewed discussions to address the disapproval at the conclusion of that rulemaking. On February 24, 2016 the Missouri Coalition for the Environment sued the U.S. EPA citing EPA's failure to perform its mandatory duty pursuant to section 303(c)(3) of the Clean Water Act (33 U.S.C. § 1313(c)(3))to promulgate numeric nutrient criteria for the state of Missouri. The case is pending.

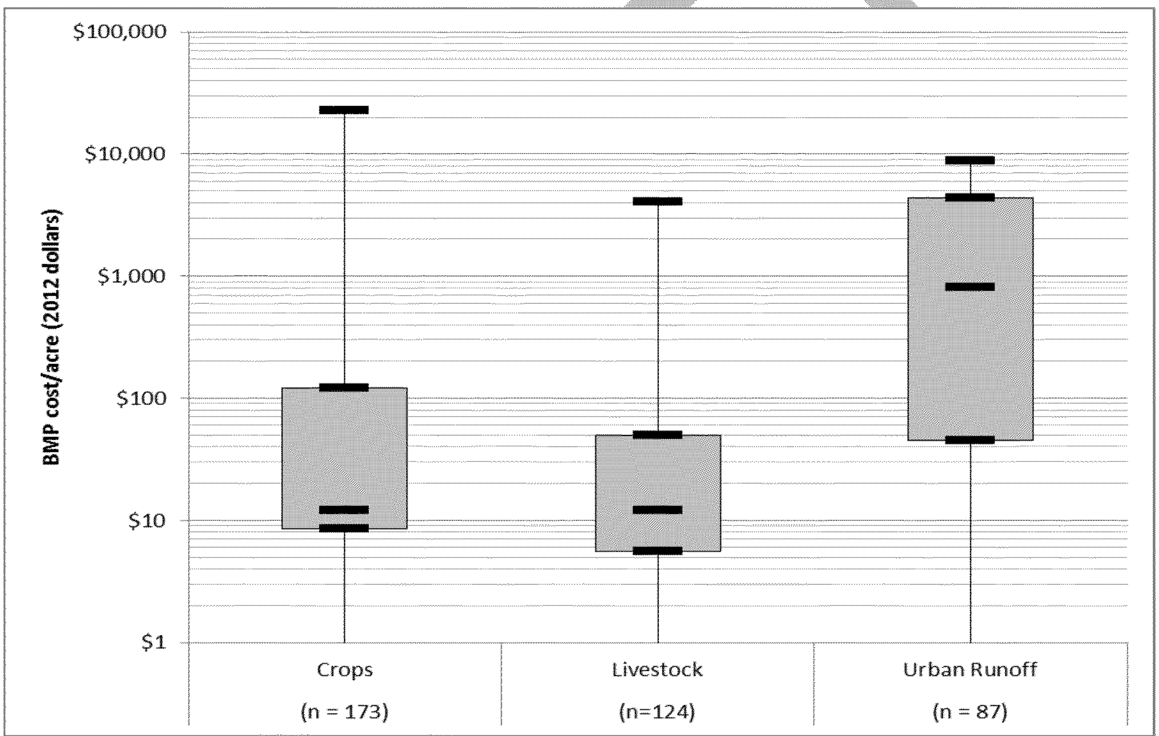
Figure 4.4. Interquartile and total range of upgrade costs for meat and poultry processors to control nutrient discharge (US EPA 2015a).



Nonpoint Source Control

Mitigation of nutrient pollution from agricultural activity and urban runoff may be accomplished by implementing a wide variety of BMPs. Agricultural BMPs include structural practices, such as detention basins, buffer strips, and terracing, as well as management practices, such as cover crops, conservation tillage, and nutrient management plans. Urban runoff structural BMPs also include detention basins, but also include infiltration basins and wetland basins. Management practices include street sweeping and education programs to control fertilization and pet waste. Distributions of BMP costs per acre are in Figure 4.5. The department is unable at this time to determine how many BMPs would be initiated as part of implementation of this rule.

Figure 4.5: Interquartile and total ranges of BMPs to control nutrient runoff in agricultural and urban environments (US EPA 2015a)



l. Water Quality Standards Variances

The proposed rule revisions to add clarification to the existing, approved variance language regarding state and federal variance procedures should not result in significant environmental and economic costs and benefits. However, the proposed revisions should provide needed clarity and reduce confusion on the applicability of state and federal variance procedures.

The incorporation by reference of Missouri's Multiple-Discharger Variance (MDV) framework will provide economic relief to individual permittees that may seek this variance. The MDV framework will require maintenance of the highest attainable effluent conditions that can be achieved from a well-functioning lagoon system without causing widespread social and economic impact. Additional required measures, such as a Pollutant Minimization Program (PMP), will improve processes and pollutant controls that will prevent and reduce pollutant loading from the facility. Monitoring and annual reporting will be required of the facility to ensure progress toward pollutant minimization and achievement of highest attainable effluent conditions. It is not anticipated that granting of individual variances under the MDV will jeopardize human health or the environment. Environmental benefit could be realized as the MDV provides an incentive for municipal facilities to direct already scarce resources toward cost-effective improvements in their infrastructure, which may not happen otherwise, and which will likely have both direct and ancillary benefits to water quality.

m. Miscellaneous Text Revisions

No significant economic and environmental costs or benefits are expected to result from the revision of internal references, correction of typographical errors or updating of formatting.

5. **The probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenue.**

As the agency responsible for environmental rules and regulations, the Department of Natural Resources may incur costs for the implementation and enforcement of the proposed rule. Other state agencies that have a regulatory interest in environmental control and process may also have costs that may arise due to the Department's rulemaking efforts. This section of the report lists probable costs to the agency, to any other agency, and any anticipated effect the rule may have on state revenue for each revision:

a. Waters of the State Definition

The fiscal note prepared to accompany HB 92 (No. 0070-01; February 19, 2015) provided information on the economic costs of the proposed legislation that is being implemented through the proposed revision. The fiscal note projected no fiscal impact (i.e., $0) for state and local governments and small businesses as a result of the proposal and its implementation. The fiscal note also projected no direct fiscal impact and no net effect (i.e., $0) on general revenue, other state funds, local funds or federal funds received by the state. Given the proposed revision is to replace an existing definition in regulation with reference to the updated definition in statute, no fiscal impact to the agency, any other agency or general revenue is anticipated as documented in the legislative fiscal note.

b. Mixing Zones and Zones of Initial Dilution

The proposed revisions will lead to more accurate delineation of mixing zones for those permitted facilities that elect to conduct the studies and greater clarity of the expectations for zones of passage and sensitive species protection. It is unlikely that the proposed addition of site-specific mixing zone provisions in rule will add any significant work or cost to the department or to any other agency. The department currently reviews and processes site-specific permit applications in a timely manner. The proposed revisions would not change the department process for the review of permit applications. Staff would perform reasonable potential analyses and calculate waste load allocations for water quality-based effluent limitations in the same manner as done currently. Additional review and guidance for developing site-specific mixing zone studies will occur as currently done for permitted facilities that use the provision elsewhere in rule. No increased costs to the department or any other state agency are expected and no effects on state revenue are anticipated.

c. Hardness

The proposed rule changes the hardness criteria from a lower quartile (twenty-fifth percentile) to a median value. The department currently reviews and processes site-specific permit applications, water quality criteria derivations and water quality assessments that require hardness value calculations. Changing the hardness derivation process from a lower quartile to a median represents a change in process, but one that would not be linked to costs to the agency or to any other agency. The change merely substitutes one statistical calculation endpoint with another, without changes to data quality or quantity requirements. No increased costs to the department or any other state agency are expected and no effects on state revenue are anticipated.

d. pH

The proposed revision to clarify the pH criteria is not anticipated to result in costs to the department or any other state agency. The department will continue to monitor and assess waters for compliance with the criteria and clarification will not change department processes. The proposed revision is not anticipated to have an effect on state revenue.

e. General Criteria Revisions

The proposed revisions to the general criteria portion of the water quality standards merely clarify the operative language already contained in the effective rule or are a requirement of the federal clean water act. These revisions are not anticipated to result in costs to the department or any other state agency and no effects on state revenue are anticipated.

f. Antidegradation Implementation Procedure

This revision updates reference to Missouri's Antidegradation Implementation Procedure in rule. No costs to the department, other agencies or general revenue are anticipated as this rule revision merely updates a reference to a document approved by the Missouri Clean Water Commission.

g. Losing Stream Reference and Table J

The proposed rule revisions should lead to more timely delivery of updated losing stream information to department staff, interested stakeholders and the public. These improvements will result in increased work efficiency and a reduction of costs for the department and the Missouri Secretary of State which publishes and updates the tables in regulation. These revisions are not anticipated to result in costs to the department or any other state agency. In addition, no effects on state revenue are anticipated.

h. Remove Table K, Site-Specific Criteria

The proposed revision removes disapproved or expired site-specific dissolved oxygen criteria from rule. The revision cleans up the administrative record for the affected water body segments and clarifies what dissolved oxygen criteria apply to those waters. Because the disapproved criteria were not yet effective for clean water act purposes, the department's work during water quality assessment or permit reviews will remain the same. The revision is not anticipated to result in costs to the department or any other state agency, nor are there anticipated effects on state revenue.

i. Missouri Use Designation Dataset Update

The proposed rule revisions should lead to more consistent and clear delineations of water bodies in the state and lead to increases in work efficiency and a reduction of costs for the department. The revision is not anticipated to result in costs to the department or any other state agency, nor are there anticipated effects on state revenue.

j. Section 304(a) Water Quality Criteria

The proposed revisions would not change the department process for the review of permit applications. Staff would perform reasonable potential analyses and calculate waste load allocations for water quality-based effluent limits in the same manner as done currently. Although the results of these analyses may be different, the amount of time involved with the effort will be the same. Therefore, no increased costs to the department are expected from this proposed rule. The proposed rule is also not anticipated to effect state revenue.

k. Numeric Nutrient Criteria for Lakes

While the proposed revisions would not change the department process for the review of permit applications, the review process may lengthen by a small amount. Approximately 1,000 facilities may need to implement additional treatment to achieve compliance, under a worst-case scenario (Table 4.2). The department will be required to conduct a review of these permits for "reasonable potential" for exceeding the new criteria and evaluate treatment plans to ensure compliance. Affordability analyses and compliance schedules would be established as per current department processes. As a result, no new costs are anticipated for the department in regard to permit issuance.

Increased monitoring by the department will be necessary to perform a complete assessment of water quality in lakes with nutrient criteria. Baseline monitoring sufficient to conduct water quality assessments will be needed for those lakes where data are not available in quantity or quality to conduct an assessment. For those lakes where a weight of evidence approach will be required, additional monitoring and investigation will be needed. Monitoring costs for both baseline assessment of water quality and for the weight of evidence analysis can be found in Appendix D.

l. Water Quality Standards Variances

The proposed rule revisions to add clarification to the existing, approved variance language regarding state and federal variance procedures is not anticipated to result in costs to the department or any other state agency and is not anticipated to have an effect on state revenue.

The incorporation by reference of Missouri's Multiple-Discharger Variance (MDV) framework is likewise not anticipated to result in costs to the department or any other state agency and is not anticipated to have an effect on state revenue. The department currently performs economic analyses for municipal facilities upon renewal and the cost analysis of treatment alternatives will follow established procedures. Determination of whether a facility qualifies as a well-functioning lagoon system, and the resulting highest attainable effluent condition, will be incorporated into the current permit renewal process following approval of the variance. Variances are currently reviewed by existing staff on a case-by-case basis and no additional resources are anticipated for these efforts. Natural Heritage Review reports required under the MDV are anticipated to be completed by existing staff at the Missouri Department of Conservation as is current practice.

m. Miscellaneous Text Revisions

No costs to the department or any other agency is expected from the revision of internal references, correction of typographical errors or updating of formatting. These revisions are likewise not anticipated to have an effect on state revenue.

6. <u>A comparison of the probable costs and benefits of the proposed rule to the probable costs and benefits of inaction, which includes both economic and environmental costs and benefits.</u>

One of the state's greatest natural resources is its abundant water. The WQS regulations are designed to protect and preserve that resource for the beneficial use of this and future generations. If this rulemaking does not become effective, some of those resources may not be protected to the extent required by federal law. Many of these impacts are immeasurable in terms of costs simply because the exact effects from lack of action are incalculable. While the potential economic cost explained in Section 4 of this report may be significant for portions of the rulemaking, no comparison can be made to environmental benefits without associating a cost to lowered health of citizens and the diminished resources that this rulemaking is intended to prevent.

The state of the economy depends to some extent on the state of the environment. For example, an area that can advertise good water quality is attractive to many human activities, from tourism to industry. Investments in infrastructure to meet regulatory requirements can also be a benefit to public and private facilities that wish to improve capacity or customer service. Improved infrastructure can attract additional industry and customers which, over time, can help subsidize and repay any costs incurred for the improvements. The following compares the probable costs and benefits of the proposed rule to the probable costs and benefits of inaction, which includes both economic and environmental costs and benefits for each item:

a. Waters of the State Definition

As described in 4a, no environmental and economic costs or benefits are anticipated as a result of the rule revision. Because the proposed revision updates state regulation to be consistent with state statute, inaction would allow inconsistencies between regulation and statute to persist. These inconsistencies could cause confusion and the need for resources to be expended to reconcile differences between regulation and statute on a case-by-case basis. The type and quantity of scenarios where inconsistencies may arise is difficult to estimate and quantify. As a result, the environmental and economic costs of inaction are likewise difficult to estimate and quantify. In general, however, inconsistencies will likely slow implementation of state and federal clean water law and environmental outcomes may be reduced.

b. Mixing Zones and Zones of Initial Dilution

Rule language clarifying that site-specific mixing zone determinations are allowed for stream flows greater than 20 cubic feet per second will have probable costs and benefits as described in 4b. While currently allowed in practice, specifically adding site-specific mixing zone determination allowances in rule for these flows will ensure clarity and understanding that the option is available. Inaction may result in continued confusion as to whether site-specific mixing zones would be allowed at these higher flows since they are not explicitly mentioned in rule. Revisions to mixing zone and zone of initial dilution conditions will also have the probable costs and benefits as described in 4b. These revisions will clearly state the expectations for zones of passage and protection of sensitive species currently in practice and ensure clarity for these provisions. Inaction may result in confusion or lack of clarity as to the expectations that apply to mixing zones and zones of initial dilution, and protection of sensitive species within these areas.

c. Hardness

The probable costs and benefits for revising the hardness definition and derivation methodology to a median are described in 4c. Inaction may result in episodes of noncompliance for those discharger specific situations where effluent limitations derived using the twenty-fifth percentile are difficult to achieve. It is anticipated, however, that differences in effluent limitations using the lower quartile and median values for hardness will be minor in most areas of the state (e.g., Big Rivers and Plains). More significant differences will likely exist where ecoregional hardness values are lower (e.g., the Ozarks) and not as variable. In these areas of the state, inaction will leave in place a more conservative water quality criteria target that to some would be an environmental benefit. Those permitted facilities requiring treatment to meet the lower-quartile hardness based effluent limitations might continue to see costs for treatment, but the magnitude of such costs is uncertain due to site-specific factors.

d. pH

As noted in 4d, revisions to clarify that the pH criteria are four-day average, chronic criteria may provide some relief to permitted facilities that discharge to waters with limited to no assimilative capacity. As also detailed in 4d, no economic costs are expected and some economic benefit may occur with minimal to no environmental costs or benefit. Inaction would result in perpetuation of an erroneous interpretation of the criteria as acute, instantaneous criteria rather than chronic.

e. General Criteria Revisions

As noted in 4e, no significant economic or environmental costs or benefits are expected to result from the revision of general criteria provisions. Inaction may allow any confusion that surrounds the provisions of the general criteria to persist and would also be a missed opportunity to clarify general criteria for protection against the effects of nutrient enrichment and to add required protection of downstream waters to state regulation.

f. Antidegradation Implementation Procedure

This revision updates the regulation to reference an updated procedure, allowing the department and others to use the document for Clean Water Act purposes. Inaction would leave the department unable to implement antidegradation water quality standards currently found in rule through the permit process. The inability to effectively implement antidegradation policies and procedures would be a significant program deficiency, one which EPA would consider during future program delegation reviews.

g. Losing Stream Reference and Table J

The proposed revision removes outdated tabular information from the rule and replaces it with reference to current and readily available digital geospatial information. No costs are expected to be created by this action. Some savings may be realized through reduction in costs for rule production and duplication. Inaction would perpetuate inconsistencies between outdated or incorrect losing stream locations in the published tables and the more accurate and up to date geospatial data. Removing the outdated tables and referencing the geospatial data should eliminate confusion in locating the losing stream segment for Clean Water Act purposes.

h. Remove Table K, Site-Specific Criteria

The proposed revision will remove disapproved or expired site-specific dissolved oxygen criteria from rule and will clarify the criteria that apply to these waters. Because the disapproved criteria were not yet effective for clean water act purposes, no costs or benefits to the economy or environment are expected to be created by this action. Inaction (i.e., leaving the disapproved or expired site-specific criteria in rule) would result in confusion as to the applicability of the site-specific criteria since EPA and state decisions on the criteria would not be reflected in regulation.

i. Missouri Use Designation Dataset Update

The proposed revisions incorporate and update water body features according to the effective, approved rule. As a result, no costs are expected to be created by these revisions. The revisions should eliminate confusion in locating and using the water body segments for Clean Water Act purposes and may result in some cost savings and efficiencies. Inaction would defer needed updates to the MUDD until a later date, potentially causing confusion as to which waters are covered by designated uses in rule.

j. Section 304(a) Water Quality Criteria

With adequate data from the facilities impacted, a comparison could be made between the increased or decreased costs in treatment and the revisions in water quality criteria which would result from this amendment. However, monitoring data are insufficient to determine the specific magnitude to which treatment systems would be affected although general estimates can be made (Appendix A, Tables 1 & 2 and supporting documentation). Inaction with regard to promulgating Section 304(a) water quality criteria would compel EPA to notify the state of the deficiency and promulgate these criteria at the federal level if Missouri is unresponsive. The difference in cost and impact of EPA promulgating these criteria instead of the state is not expected to be significant.

k. Numeric Nutrient Criteria for Lakes

The following consequences of inaction are specified in EPA's June 1998 National Strategy for the Development of Regional Nutrient Criteria:

"…if EPA determines that a new or revised nutrient standard is necessary for a State or Tribe (because EPA determines that the State or Tribe has not demonstrated reasonable progress toward developing numerical nutrient standards), EPA will initiate rulemaking to promulgate nutrient criteria values…"

If, due to inaction, EPA has to promulgate nutrient criteria, it is probable that criteria set by EPA would be more restrictive and less site-specific than what are in the proposed rule. These criteria could result in reduced regulatory flexibility for both the department and the regulated community, which could result in higher costs for compliance due to the more restrictive standard.

Failure to protect a water body from excessive nutrient loading can be economically devastating to a community. In 2009 and 2010, Grand Lake St. Mary's, a 13,000 acre lake in Ohio, was the site of large algal blooms and fish kills. High concentrations of toxins produced by blue-green algae prompted Ohio EPA to post warning signs advising people to not contact the water. There were 23 cases of human illness, and several dog deaths that were associated with the blooms. The local tourism industry, which previously accounted for $150 million in annual economic activity, suffered losses of between 23 and 30 percent. Several boat dealers, marinas, and other small businesses closed. The city of Celina, which draws its drinking water supply from the lake, spent over $13 million in upgrades to control taste and odor problems in the treatment process (Davenport and Drake, 2011).

In Waco, TX, the public water supply system, for which the source water supply is Lake Waco, had to spend an estimated $70.4 million between 2002 and 2012 to treat taste and odor problems that resulted from high nutrient loading and algal blooms. Additionally, they lost between $6.9 million and $10.3 million in revenue due to the withdrawal of neighboring communities from the utility (Dunlap et al., 2015).

In Missouri, there are 45 public water supply systems that withdraw source water from lakes and reservoirs (MDNR, 2015). Inaction would leave these source waters unprotected, negatively impacting the primary drinking water supply for many communities. Additionally, any secondary water systems that utilize water from these public water supply systems would also be impacted. Reducing nutrients in source water will lead to concomitant improvements in finished water, more efficient and cost-effective water treatment, and a longer useful life of the source water supply.

l. Water Quality Standards Variances

As noted in 4l, no significant economic or environmental costs or benefits are expected to result from the clarification of existing, approved variance language. Inaction may allow any confusion that surrounds the existing provisions to persist and would be a missed opportunity to clarify these provisions in state regulation.

As also noted in 4l, the incorporation by reference of Missouri's Multiple-Discharger Variance (MDV) framework will provide regulatory flexibility and economic relief to individual permittees that may seek this variance. Incorporation of the framework by reference will also streamline the variance review and approval process for this specific group of dischargers. Increases in efficiency gained through the framework should translate into net gains in environmental improvement for the facility and the state. Inaction would require individual facilities to go through the site-specific variance authorization and approval process, which would ultimately result in delays in environmental improvement.

m. Miscellaneous Text Revisions

Neither action nor inaction to make the proposed rule text revisions would result in any significant difference in the costs or benefits associated with this rulemaking.

7. **A determination of whether there are less costly or less intrusive methods for achieving the proposed rule.**

Regional organizations, county governments, or municipal governments could enact laws or policies that provide similar or greater protection of water resources within their jurisdiction. This has been done in a few select areas of the state, but does not provide adequate protection for the entire state population or its water resources. As a result, statewide action through rulemaking is required for these items. EPA requires a regulatory program to ensure the effective administration of clean water standards. No other state agency has the authority or funding source to administer such a program. EPA has delegated its authority only to the Department for administering a water quality program, and that delegation hinges on the program being functionally equivalent to the federal Clean Water Act. The following discussion includes determinations of whether there are less costly or less intrusive methods for achieving the proposed rule for each item:

a. Waters of the State Definition

The proposed revision updates Missouri's water quality standards regulation to be consistent with recently passed and enacted changes in state statute. Because state regulations implement state statute, and must be consistent with them, the proposed revisions must be promulgated into rule. Therefore, there are no known less costly or less intrusive methods for achieving the proposed rule.

b. Mixing Zones and Zones of Initial Dilution

Site-specific mixing zone determinations for permitted facilities discharging to waters with 7Q10 low-flows greater than 20 cubic feet per second have been conducted by permit applicants and the department in the past. Revising the mixing zone provisions in rule for these flows is the only reasonable alternative to ensure current practice is embodied in regulation for dischargers to these flows. Clarifying the expectations and requirements for mixing zones and zones of initial dilution as proposed will place current practice and implementation for these areas in rule. Less costly or intrusive methods for making these clarifications are not known.

c. Hardness

This revision does not create any new requirements or any costs; in fact, the revision may result in cost savings and benefits without negative effects to water quality. The purpose of the revision is to improve the manner in which the water quality standards for hardness dependent metals are implemented across the state. It should not result in any change in the cost of compliance and should lessen any potential for confusion regarding implementation of these criteria in permits and water quality assessments.

d. pH

Revising the pH water quality criteria to clarify that pH criteria are four-day average, chronic criteria does not create any new requirements or any costs. In fact, clarifying the duration of the criteria helps refine the regulation to ensure greater compliance and understanding of the rule. The proposed revisions will ensure discharges with limited assimilative capacity have a clear understanding of regulatory requirements while still protecting water quality standards.

e. General Criteria Revisions

Clarifying the applicability of chronic and acute toxicity and adding provisions for the prevention against the effects of nutrient enrichment and protection of downstream uses does not create any new requirements or any costs. It is reasonable that important or complex portions of the rule are clarified to ensure greater compliance and understanding of the effective rule. Clarifying toxicity requirements and the prevention of impacts from excess nutrients within the general criteria is reasonable and methods that may be less costly or intrusive are not known. It is likewise reasonable that required elements of the federal clean water act are included in state regulation (i.e., protection of downstream uses) to ensure state water quality standards are functionally equivalent to federal standards.

f. Antidegradation Implementation Procedure

This revision updates reference to Missouri's Antidegradation Implementation Procedure (AIP) in rule. The revision does not create new requirements or costs since it incorporates by reference a document that went through the public participation process and was approved by the Missouri Clean Water Commission. No other less costly or intrusive option exists to achieve the objective of the revision.

g. Losing Stream Reference and Table J

The proposed revisions do not impose any new costs nor do they require significant changes in efforts to achieve compliance. Therefore, no other less costly or intrusive option exists to achieve the objective of the revisions.

h. Remove Table K, Site-Specific Criteria

The proposed revision to remove Table K does not impose any new costs nor does it require significant changes in effort to achieve compliance. Therefore, no other less costly or intrusive option exits to achieve the objective of the revision.

i. Missouri Use Designation Dataset Update

The update to the MUDD will incorporate and update water body features according the effective and approved rule using the latest peer-reviewed, scientific information. These revisions should not impose any new costs on dischargers nor will they require significant changes in efforts to achieve compliance. Therefore, no other less costly or intrusive option exists to achieve the objective of this revision.

j. Section 304(a) Water Quality Criteria

Other methods for achieving the proposed rule, such as a time-limited variance from the water quality standard or the use of another method for criteria development, would likely result in more stringent criteria. The federal criteria allow for some refinement of criteria to site-specific conditions through procedures called "species recalculation" and "water effects ratio". However, these procedures are highly site-specific and resource intensive and, as such, would not be considered less costly or less intrusive methods.

k. Numeric Nutrient Criteria for Lakes

The department is proposing numeric nutrient criteria that address an EPA disapproval and less costly or less intrusive methods are not known. Development of the proposed criteria involved numerous discussions and meetings with general and technical workgroups. Because of the mix of participants in these groups, criteria development focused on finding the most scientifically defensible criteria that protected applicable designated uses. The proposed criteria reflect natural variations in reactions to nutrient loads and take into account ecoregional differences. The proposed rule also provides mechanisms to arrive at confident water quality assessment and impairment decisions. Given these considerations, the proposed criteria are the most effective that can be developed at this time.

l. Water Quality Standards Variances

Clarifying the expectations and requirements for water quality standards variances as proposed will place current practice and implementation in rule. Less costly or intrusive methods for making these clarifications are not known.

Incorporating by reference Missouri's Multiple-Discharger Variance framework will provide regulatory flexibility and economic relief to individual permittees that may seek this variance. Efficiencies gained through the MDV process make it the most cost effective method of granting variances for a specific category of dischargers. No other less costly or intrusive option exists to achieve the objective of this revision.

m. Miscellaneous Text Revisions

The revisions to rule text proposed in this rulemaking are the only reasonable alternative for addressing the errors and inconsistencies. No other less costly or intrusive option exists to achieve the objective of this revision.

8. <u>A description of any alternative method for achieving the purpose of the proposed rule that were seriously considered by the department and the reasons why they were rejected in favor of the proposed rule.</u>

For most water quality rules, EPA guidelines and guidance offer justification and rationale for the selection of the proposed standards and the Department typically defers to EPA's rationale for the science used in developing the standards. In order to establish standards other than those contained in EPA's guidelines and guidance, the state would need to provide rationale that is equally thorough and pervasive. Such an effort could take years and significant resources, and would likely not result to standards any different from those developed by EPA. However, where the state has flexibility to establish its own requirements (e.g., mixing zones, low flows, and variances), revisions will be supported by the state's rationale and justification. The following provides a description of any alternative methods for achieving the purpose of the proposed rule that were seriously considered by the department and the reasons why they were rejected in favor of the proposed rule for each item:

a. Waters of the State Definition

As noted in 7a, the proposed revision updates Missouri's water quality standards regulation to be consistent with recently passed and enacted changes in state statute. The proposed revisions implement the enacted statutes in state regulation. No alternative methods for achieving the purpose of the proposed rule were seriously considered because state regulations must be consistent with the provisions of state statute.

b. Mixing Zones and Zones of Initial Dilution

The proposed mixing zone revision was submitted by stakeholders in response to the department's "Public Notice of Intent to Initiate Triennial Review of Missouri Water Quality Standards." The revision remedies an oversight in the mixing zone regulation whereby site-specific mixing zone determinations were not provided in rule for dischargers to 7Q10 low-flows greater than 20 cubic feet per second. The revision to mixing zone and zone of initial dilution requirements was incorporated by the department to help clarify the expectations and extent of these areas in rule. An alternative method would be to not make the revisions in rule and continue to allow these studies and protections as is current practice. This alternative was rejected since the department believes that placing the provision and revision in rule help clarify current practice and protections.

c. Hardness

The proposed revision to change the hardness definition and derivation methodology in rule was submitted by stakeholders in response to the Department's "Public Notice of Intent to Initiate Triennial Review of Missouri Water Quality Standards." Research by the department indicates that many other states use the median or arithmetic average for hardness calculations when prescribed in rule. Research of archived water quality standards regulations also indicate that prior to 1994 Missouri also used an arithmetic average of the available data. Revision to a median value should not result in additional or unacceptable toxicity in Missouri's waters. Alternative regulatory approaches include not specifying the hardness derivation methodology in rule and using another percentile for the derivation. Placing the derivation methodology in rule provides transparency and clarity on how the derivation of these values will occur. Any other alternative percentile would need substantial justification to ensure it is not arbitrary and would ensure sufficient protection of the resource. Both of these alternative regulatory methods were rejected in favor of the proposed revision.

d. pH

The proposed rule change to the pH criteria was submitted by stakeholders in response to the Department's "Public Notice of Intent to Initiate Triennial Review of Missouri Water Quality Standards." Research by the department indicates that many states, including those that border Missouri, interpret pH as a chronic rather than an acute condition. The proposed revisions requested by stakeholders will aid in clarifying the intent and protections of the pH criteria. An alternative regulatory approach includes not revising the pH criteria and leaving the duration of the pH criteria up to interpretation. This alternative approach would result in no change to the water quality standards regulation and was rejected in favor of the proposed revision due to the greater clarity the proposed revision provides.

e. General Criteria Revisions

The proposed revision to toxicity language in the general criteria was submitted by stakeholders in response to the Department's "Public Notice of Intent to Initiate Triennial Review of Missouri Water Quality Standards." The revision provides clarity in the general criteria as to where chronic and acute toxicity may be allowed by permit. An alternative method would be to not make the revision in rule and continue with the current rule language. This alternative was rejected since the department agrees that placing the provision in rule clarifies that allowance of chronic and acute toxicity in certain situations. It also provides the opportunity to update and clarify toxic unit applicability to these criteria.

The proposed addition of general criteria for the prevention and protection of waters from the effects of nutrient enrichment clarifies existing implementation of the general criteria as they pertain to nutrients. An alternative method would be to not make the addition in rule and continue with the current rule language. This alternative was rejected since the department believes the addition will provide greater clarity in the general criteria with respect to nutrients and provide greater support for efforts geared toward nutrient reduction in the state.

The proposed addition of general criteria for the protection of downstream uses was prompted by existing requirements in federal regulation at 40 CFR 131.10(b) to protect downstream uses. The additional, required provision will ensure consistency with the requirements of the federal clean water act and it's implementing regulations in Missouri's water quality standards. An alternative method would be to not make the addition in rule and continue to implement downstream use protections via other state water quality programs, such as permitting, TMDLs, and water quality standards development. This alternative was rejected because placing the provision in rule ensures consistency with federal regulatory requirements with respect to downstream use protection and solidifies current practice in state water quality standards.

f. Antidegradation Implementation Procedure

Because the department does not have an alternate AIP approved by the Commission, the method chosen to reference the most recently approved AIP is the only method available to satisfy the requirements of EPA and the rule.

g. Losing Stream Reference and Table J

The department relies on geologic and hydrologic field surveys to delineate the location and extent of losing stream segments. Determining boundaries of losing stream segments in terms of paper maps and legal descriptions (as presented in Table J) can be extremely inaccurate. Water body delineation and measurement using these methods may lead to either an under-application or over-application of the losing stream extent and criteria. The proposed revisions to incorporate accurate digital geospatial information should eliminate these potential problems by using more accurate digital data for use in developing permits and conducting water quality assessments.

h. Remove Table K, Site-Specific Criteria

State developed site-specific criteria must be based on sound scientific rationale and protect applicable designated uses per 40 CFR 131.11(a)(1). The department has not received additional data, information or interest from which to develop revised site-specific dissolved oxygen criteria in response to EPA's disapproval or the expired criteria. Therefore, the alternative of proposing revised criteria was rejected due to lack of new information and resources to continue the proposal. Removing Table K from regulation will provide clarity that these criteria are no longer applicable for clean water act purposes. Should the department receive interest or information from which to establish site-specific dissolved oxygen criteria, those actions will be considered during a future rulemaking.

i. Missouri Use Designation Dataset Update

The department has previously extrapolated the location and extent of water bodies from paper maps and reported their boundaries in terms of legal descriptions. This method of water body delineation and measurement is relatively inaccurate and may lead to either an under-application or over-application of the beneficial uses and criteria to waters covered by this rule. The proposed revisions will eliminate these potential problems by using more accurate GIS and field data to achieve the proposed rule revisions.

j. Section 304(a) Water Quality Criteria

Alternatives to Section 304(a) numeric water quality criteria include development of site-specific criteria for individual pollutants through species recalculation, water effects ratios or other methods. The revisions proposed were preferred as the most science-based alternative that would broadly protect aquatic communities.

k. Numeric Nutrient Criteria for Lakes

The specific effects of nutrient loading on designated uses are difficult to quantify due to uncertainties associated with the relationship between causal variables (i.e., nitrogen and phosphorous) and response variables (chlorophyll-a). The tolerance of a waterbody for nutrient loading also varies with a number of factors, including local hydrology, geology, land cover and climate. Overall, however, excessive nutrient loading has been amply demonstrated to degrade the beneficial uses of surface waters.

Like the current proposal, several earlier drafts of the rule divided state numeric nutrient criteria by ecoregion to account for regional differences in hydrology, geology, land cover and climate. In contrast to the current proposal, earlier drafts derived predicted values for total phosphorus based largely on hydrologic factors in the Plains region and regional factors in the Ozarks. These early drafts also established a range between advisory and action levels to account for the uncertainty associated with the extent of nutrient loading that would lead to environmental degradation. These approaches lacked specific links to beneficial uses of water bodies, and also lacked identification of reference waters to be used as bench marks. The current draft resolves those deficiencies and refines the hydrologic approach.

l. Water Quality Standards Variances

The proposed revisions clarify expectations and requirements for water quality standards variances at the state and federal levels. An alternative method would be to not make the revision in rule and continue with the current rule language. This alternative was rejected since the department believes that clarifying existing expectations and requirements is needed to ensure appropriate and efficient use of variances and to resolve disapproval of existing language.

As noted in previous sections, incorporating by reference Missouri's Multiple-Discharger Variance framework will provide regulatory flexibility and economic relief to individual permittees that may seek this variance. An alternative method would be to require all dischargers covered by the MDV to proceed through the individual variance application and approval process. This alternative was rejected since the department believes that the MDV process will result in greater efficiencies to the department, greater economic relief and flexibility to the permittee, and will ultimately lead to greater environmental improvement as variances are implemented.

m. Miscellaneous Text Revisions

The proposed revisions to the rule text to update internal references, correct typographical errors and improve formatting are the only reasonable alternative for addressing these errors.

9. An analysis of both short-term and long-term consequences of the proposed rule.

Rulemaking has inherent short- and long-term consequences that must be considered in the regulatory impact report process. Consequences of the short and long term could be fiscal, environmental, legislative or any other adverse condition that may arise as a result of implementation of the proposed rule. To the extent that short- and long-term consequences can be estimated for the proposed rule, those have been listed in the following section for each item:

a. Waters of the State Definition

The proposed revisions implement enacted statutes in state regulation. Inconsistencies between enacted statutes and outdated regulations could have short-term consequences for rule implementation due to differences between the regulation and statute. Ultimately, state statute takes precedence over state regulation and any inconsistency between the two would be resolved over time. Due to the periodic review requirements of state water quality standards by state and federal regulation, long-term consequences due to inconsistencies are not anticipated since the water quality standards regulation should be updated at least once every three years.

b. Mixing Zones and Zones of Initial Dilution

The proposed rule to clarify site-specific mixing zone allowances and existing provisions does not create any new requirements or costs. The purpose of the revisions is to improve the clarity of the rule and codify applicability of site-specific mixing zone allowances at stream low-flows greater than 20 cubic feet per second. It should not result in any change in the cost of compliance and should lessen any potential for confusion regarding implementation of the rule.

c. Hardness

The rule revision to change the hardness derivation methodology from a lower quartile to median value does not create any new requirements or costs. The purpose of the revision is to revise the rule to more accurately reflect average or common values of hardness. It should not result in any change in the cost of compliance and should lessen any potential for confusion regarding implementation of the rule. As a result, no short-term or long-term consequences are anticipated.

d. pH

The proposed rule revision to clarify the pH criteria in regulation as four-day average concentrations protective against chronic toxicity should offer both short and long term relief to discharges with limited assimilative capacity receiving streams. The revision should not result in any change in the cost of compliance and should lessen any potential negative impacts to facilities that may need relief where assimilative capacity is limited. Because EPA criteria documentation supports the notion of pH criteria as chronic, four-day average concentrations, no short or long term environmental consequences are anticipated following the rule revision and implementation.

e. General Criteria Revisions

The proposed rule to clarify toxicity provisions within the general criteria, and the addition of narrative protection against the effects of nutrients and for protection of downstream uses, should not result in any change in the cost of compliance or administration of the rule. The revisions should serve to lessen any potential for confusion regarding implementation of the rule through clean water act programs. No short-term or long-term consequences are anticipated as a result of implementation of the proposed rule.

f. Antidegradation Implementation Procedure

The revision updates reference to Missouri's Antidegradation Implementation Procedure (AIP) at 10 CSR 20-7.031(3)(D). The short and long term consequences of the proposed revision are the same as it provides the department and others with a Missouri Clean Water Commission approved AIP that can be formally submitted to EPA for use and approval of future permitting and antidegradation decisions.

g. Losing Stream Reference and Table J

The proposed rule revisions will improve the efficiency and identification of losing stream segments statewide, making it easier to track the various types of information relative to each water body, such as the standards that apply, the status of water quality, the discharges affecting the water body, etc. These losing stream identifications are essential to decisions relating to effluent limitations, compliance determinations and water quality restoration activities.

h. Remove Table K, Site-Specific Criteria

The disapproved and expired site-specific dissolved oxygen criteria in Table K have not been effective or applicable for clean water act purposes due to federal regulations at 40 CFR 131.21 regarding WQS review and approval. As a result, no short or long-term consequences are anticipated as a result of the proposed revision to remove disapproved or expired criteria. Active and effective criteria in Missouri's WQS regulation for dissolved oxygen (i.e., 5.0 mg/L minimum) will continue to apply as during the period between site-specific criteria promulgation and EPA disapproval.

i. Missouri Use Designation Dataset Update

The proposed rule revisions will improve the identification of water body features, making it easier to track the various types of information relative to each water body, such as the standards that apply, the status of water quality, the discharges affecting the water body, etc. These identifications are essential to decisions relating to effluent limitations, compliance determinations and water quality restoration activities.

j. Section 304(a) Water Quality Criteria

The short-term and long-term consequences of this rule amendment are the same: the protection of aquatic habitat and human health without imposing unnecessary costs to the regulated community. Where revised Section 304(a) criteria are more stringent than currently found in rule, short-term consequences may be incurred by WWTFs. New permit conditions for these WWTFs will establish a regulatory requirement for achieving aquatic habitat and human health protection standards in the receiving stream. Some of these permits will contain schedules of compliance of appropriate length to design, build and operate treatment process upgrades. Depending on the level of treatment presently employed at each facility, the level of additional treatment needed may vary on a case-by-case basis. The long-term consequence is the annual O&M cost associated with wastewater treatment. Where revised Section 304(a) criteria are less stringent than currently found in rule, short-term and long-term consequences may include reduction of effluent limitation or monitoring frequency requirements found in the operating permit for the facility. These reductions should likewise result in a reduction in costs of either treatment or monitoring for the facility.

k. Numeric Nutrient Criteria for Lakes

Implementation of nutrient criteria will be through department monitoring and assessment of lake water quality, as well as through the establishment of nutrient effluent limits in state operating permits. The earliest water quality assessments incorporating the proposed rule would likely be reflected in the 2018 303(d) list of impaired waters, with subsequent development of total maximum daily loads (TMDL) for lakes identified as not meeting water quality standards due to nutrient impairment. Prioritization of TMDL development and implementation is subject to a number of factors, and TMDL development itself is a long-term process. Furthermore, implementation of point source controls to meet TMDL WLAs is subject to permit cycles, and other factors. The department recognizes that this process may create uncertainties for certain permitted dischargers, and is committed to minimizing delays and uncertainty in the TMDL and permitting processes. Negligible expenses associated with the proposed rule are anticipated in the short term.

Long-term expenses will include point source upgrades as described in Section 4 of this report, as well as staff time developing TMDLs and bringing discharge permits into conformance with wasteload allocations. Another long-term expense includes efforts to educate and inform landowners about the installation of best management practices in those areas where the principle nutrient contributions are from nonpoint sources. As previously mentioned, expenditures associated with installation of BMPs can, in many cases, be substantially reimbursed to landowners through state and federal conservation incentive programs.

In some situations, the expense of upgrading wastewater treatment facilities may be mitigated, by the introduction of water quality trading. This involves the exchange of credits between point source and nonpoint source operators. If a landowner can demonstrate sufficient reduction in nutrient discharge with the introduction of a new BMP, a wastewater treatment facility may gain some relief with accredited compensation to the landowner. This approach is encouraged by EPA, and several pilot programs have been developed in other states. The department is in the process of developing this approach in Missouri through the Water Protection Forum, Nutrient Trading Workgroup.

Long term cost effectiveness and environmental benefits will support increased and sustainable quality of life for all, including, individuals and community businesses, agricultural facilities and other utilities in the watershed.

l. Water Quality Standards Variances

The proposed rule to clarify existing state and federal variance procedures does not create any new requirements or costs. The purpose of the revisions is to improve the clarity of the rule and provide a straightforward description of variance procedures at the state and federal level. It should not result in any change in the cost of compliance and should lessen any potential for confusion regarding implementation of the rule.

Incorporation by reference of the Missouri Multiple-Discharger Variance framework will provide short- and long-term benefits to the state and regulated community. Municipal facilities identified in the MDV will be provided regulatory flexibility to implement upgrades and improvements to their collection and wastewater treatment systems. Implementation of the framework will ensure protection of aquatic habitat in the near-term without imposing undue burden on socially and economically stressed communities. The long-term benefit of the variance framework will be continuous improvement in water quality and pollutant reduction, while maintaining and enhancing delivery of services to the communities served.

m. Miscellaneous Text Revisions

The proposed rule text revisions will avoid any confusion or delay in decisions based on the sections of the rule affected by the errors.

10. <u>An explanation of the risks to human health, public welfare or the environment addressed by the proposed rule.</u>

Section 4 of this report details some of the risks that may exist should water quality not be protected by the new water quality standards proposed by this rulemaking. Because the Department is adopting federal standards for Clean Water Action Section 304(a) criteria, further information on risk assessment may be obtained by reviewing the administrative record created during EPA's development of their technical guidelines and guidance for these criteria. Many of the proposed rule revisions, however, do not pose or address risks to human health, public welfare or the environment. An explanation of the risks to human health, public welfare or the environment addressed by the proposed rule for each proposed revision are as follows:

a. Waters of the State Definition

The proposed rule revision provides reference in state regulation to the definition enacted in state statute, and ensures the definition of waters of the state is consistent between them. The revision does not address specific risks to human health, public welfare or the environment. Rather, the revision seeks to reduce potential conflicts or confusion between definitions found in state regulation and statute.

b. Mixing Zones and Zones of Initial Dilution

The purpose of these revisions is to improve the clarity of provisions already in rule and specify that site-specific mixing zone determinations are allowed for larger stream systems. The intent is to lessen any potential for confusion regarding implementation of the rule and promulgate what is currently common and accepted practice. The proposed rule revisions do not resolve or pose significant risks to human health, public welfare or the environment. Rather, the additional clarity offered by the revisions ensures unintentional risks do not occur singularly or collectively in Missouri waters.

c. Hardness

The revision to hardness definition and derivation methodology merely changes the statistical basis for choosing what constitutes representative hardness for Missouri streams. The intent of the change is to revise how the hardness derivation is conducted while still being protective of aquatic resources. The proposed rule changes a derivation methodology and should not result in any additional risks to human health, public welfare or the environment.

d. pH

The proposed rule revision to clarify the pH criteria as a four-day average, chronic criteria will provide some relief to discharges with limited assimilative capacity. The change has basis in pH criteria toxicity testing (EPA "Red Book") and is not expected to pose any toxicity to aquatic life under normal circumstances. Any risks to human health, public welfare or the environment would have been addressed in EPA's derivation of the criteria and can be found in that administrative record. The proposed rule revision therefore does not address or pose any risks to human health, public welfare or the environment.

e. General Criteria Revisions

The purpose of these revisions is to improve the clarity of the rule regarding whether toxicity (acute and chronic) are allowed by permit and to add language for protection against the effects of nutrients and for the protection of downstream uses. Its intent is to lessen any potential for confusion regarding implementation of the rule. The proposed rule revisions do not address specific risks to human health, public welfare or the environment.

f. Antidegradation Implementation Procedure

The revision updates reference to Missouri's Antidegradation Implementation Procedure in rule. Including reference to a Missouri Clean Water Commission approved AIP will ensure that antidegradation requirements found in rule are upheld. As a result, unnecessary or unacceptable risks to human health, public welfare and the environment will be minimized.

g. Losing Stream Reference and Table J

The purpose of these revisions is to improve the accuracy and clarity of the rule with regard to losing streams. The revisions will also increase the accuracy and efficiency of decisions made using losing stream information. Having the most up-to-date and current locations of losing streams in geospatial format will increase the accuracy of Clean Water Act activities that may use this information. As a result, unnecessary or unacceptable risks to human health, public welfare and the environment will be minimized.

h. Remove Table K, Site-Specific Criteria

The revision to remove Table K from regulation is in response to EPA disapproval and expiration of site-specific dissolved oxygen criteria contained within the table. Removing Table K will improve the clarity of state water quality standards by incorporating EPA decisions and removing outdated information. These revisions do not significantly affect any risks to public health, welfare or the environment as protective criteria for dissolved oxygen will remain in rule at 10 CSR 20-7.031, Table A.

i. Missouri Use Designation Dataset Update

The purpose of these revisions is to improve the accuracy and clarity of the rule with regard to the water bodies contained in the dataset. The revisions will also increase the accuracy and efficiency of decisions made using water body information contained in the MUDD. Having the most up-to-date and current locations and uses of water bodies in the state will increase the accuracy of Clean Water Act activities that may use this information. As a result, unnecessary or unacceptable risks to human health, public welfare and the environment will be minimized.

j. Section 304(a) Water Quality Criteria

The proposed revisions to Section 304(a) water quality criteria address the toxic effects of these pollutants to aquatic life and the toxic and carcinogenic effects of these pollutants to human health. This amendment proposes to revise the state criteria to reflect the latest federal criteria developed under Section 304(a) of the federal Clean Water Act. Further information on risk assessment may be obtained by reviewing the administrative record created during EPA's development of these documents.

k. Numeric Nutrient Criteria for Lakes

Aquatic life is impacted by nutrient loading at several levels. Nutrient enrichment can increase the probability of fish kills due to oxygen depletion that results from excessive algae growth and its subsequent decomposition. Excess nutrients can also undermine aquatic diversity by creating conditions favorable to certain fast growing species, such as carp and benthivores, at the expense of other species (Edgertson and Downing, 2004).

Drinking water issues are frequently attributed to specific species of algae that produce a range of toxins that can impact human health through ingestion and dermal exposure pathways. The consequences include taste and odor problems in drinking water and risks to human health as well as to livestock and wildlife. (Downing et al. 2001).

l. Water Quality Standards Variances

The purpose of these revisions is to improve the clarity of state and federal variance provisions already in rule and to provide reference to a multiple-discharger variance framework. Variances are time-limited and must meet specific state and federal requirements for the time period of the variance. These requirements ensure the highest attainable water quality condition is maintained without undue social or economic impact to the community. Variance terms and conditions also require continuous environmental improvement through facility upgrades and pollutant reduction activities. As a result, unnecessary or unacceptable risks to human health, public welfare and the environment will be minimized.

m. Miscellaneous Text Revisions

The proposed revisions to the rule text to update references, correct typographical errors and improve formatting do not pose any risk to human health, public welfare or the environment.

11. The identification of the sources of scientific information used in evaluating the risk and a summary of such information.

Section 2 and Appendix A of this report present information that was used in the development of the proposed rule. Because the Department is adopting federal Section 304(a) water quality criteria, further information on risk assessment may be obtained by reviewing the administrative record created during EPA's development of their guidelines and guidance for these criteria. In these cases, the Department defers to the science used in the national studies for evaluating risks to aquatic life and human health. The sources of scientific information used in evaluating the risk of the proposed revisions are listed as available:

a. Waters of the State Definition

As noted in response 10a, the proposed rule revision references enacted state statute in state regulation to ensure the definition of waters of the state is consistent. The proposed rule revision does not address specific risks to human health, public welfare or the environment. As a result, no sources of scientific information were necessary to evaluate non-existent risk.

b. Mixing Zones and Zones of Initial Dilution

As noted in response 10b, the proposed rule revisions are clarifications and do not resolve or pose any significant risk to human health, public welfare or the environment. As a result, no sources of scientific information were necessary to evaluate non-existent risk.

c. Hardness

As noted in response 10c, the proposed rule revision to the statistical derivation methodology for hardness does not resolve or pose any significant risk to human health, public welfare or the environment. As a result, no sources of scientific information were necessary to evaluate non-existent risk.

d. pH

As noted in response 10d, the proposed rule revision will clarify the pH criteria as a four-day average, chronic criteria. The criteria revisions do not adjust the range of allowable pH criteria in the water quality standards. No sources of scientific information were necessary to evaluate risk as the risks to human health, public welfare and the environment were conducted during EPA's development of the criteria and can be found in that administrative record.

e. General Criteria Revisions

As noted in response 10e, the proposed rule revisions are a clarification and addition to the general criteria and do not resolve or pose any significant risk to human health, public welfare or the environment. As a result, no sources of scientific information were necessary to evaluate non-existent risk.

f. Antidegradation Implementation Procedure

In adopting an Antidegradation Implementation Procedure on July 13, 2016 that aligns the *de minimis* provision with current regulatory requirements, the Missouri Clean Water Commission approved an AIP that provides the regulatory framework for minimizing risks to human health, public welfare and the environment.

g. Losing Stream Reference and Table J

The purpose of the revision is to improve the accuracy and clarity of the rule. The revision will also increase the accuracy and efficiency of decisions made by using the most up-to-date losing stream information. These revisions do not significantly affect any risks to public health, welfare or the environment. As a result, no sources of scientific information were necessary to evaluate non-existent risk.

h. Remove Table K, Site-Specific Criteria

The purpose of the revision is to improve the accuracy and clarity of the rule by removing disapproved and expired site-specific criteria. This change does not significantly affect any risks to public health, welfare or the environment. As a result, no sources of scientific information were necessary to evaluate non-existent risk.

i. Missouri Use Designation Dataset Update

The purpose of the revisions is to improve the accuracy and clarity of water body information referenced in the rule. The revision will also increase the accuracy and efficiency of decisions made by using the most up-to-date water body information. These revisions do not significantly affect any risks to public health, welfare or the environment. As a result, no sources of scientific information were necessary to evaluate non-existent risk.

j. Section 304(a) Water Quality Criteria

This amendment proposes to revise state criteria to reflect the latest federal criteria developed under Section 304(a) of the federal Clean Water Act. Scientific information used in evaluating risks to aquatic habitat and human health protection can be found in these documents.

k. Numeric Nutrient Criteria for Lakes

This amendment proposes to revise numeric nutrient criteria for the aquatic habitat protection and drinking water supply uses. Scientific information used in evaluating risks can be found in the documentation and data used to derive the criteria. These documents can be found in the references section and on the Water Quality Standards Workgroup web page.

l. Water Quality Standards Variances

The proposed rule revisions clarify existing state and federal variance procedures and incorporate by reference of Missouri's Multiple-Discharger Variance framework. These revisions do not resolve or pose any significant risk to human health, public welfare or the environment. As a result, no sources of scientific information were necessary to evaluate non-existent risk.

m. Miscellaneous Text Revisions

The rule revisions are not proposed on the basis of science or reducing risk. Therefore, this section is not relevant to these revisions.

12. A description and impact statement of any uncertainties and assumptions made in conducting the analysis on the resulting risk estimate.

Because the Department is adopting federal standards for portions of this rulemaking, further information on risk assessment may be obtained by reviewing the administrative record created during EPA's development of their technical guidelines and guidance. Providing information on uncertainties and assumptions would require an analysis of the preamble to the federal rule and it is uncertain that EPA documented all of the uncertainties and assumptions involved in their rule development. That stated, a description and impact statement of any uncertainties and assumptions made in conducting the analysis on the resulting risk estimate is presented for each proposed revision:

a. Waters of the State Definition

The purpose of the proposed revision is to reference enacted state statute in state regulation. It does not affect any risks to human health, public welfare or the environment and no risk analysis was conducted. Therefore, no uncertainties exist with respect to the revisions.

b. Mixing Zones and Zones of Initial Dilution

The purpose of the revisions is to improve the clarity of the rule with regard to mixing zones and zones of initial dilution. It does not affect any risks to human health, public welfare or the environment since mixing zones and zones of initial dilution are limited in extent to protect designated uses. Therefore, no uncertainties exist with respect to the revisions.

c. Hardness

The purpose of the revision is to change the definition and statistical derivation methodology for hardness in rule. It does not affect any risks to human health, public welfare or the environment since toxicity criteria are expected to be protective of aquatic life over a range of hardness values and any uncertainties in those criteria derivations would have included conservative assumptions. As a result of uncertainties being accounted for in criteria derivation, no uncertainties exist with respect to the revision.

d. pH

The purpose of the revision is to clarify the duration and averaging period of the pH criteria in rule and does not change the range of acceptable water quality conditions. It does not affect any risks to human health, public welfare or the environment since the pH criteria are expected to be protective of aquatic life and any uncertainties in pH criteria derivations would have included conservative assumptions. As a result of uncertainties being accounted for in the criteria derivation, no uncertainties exist with respect to the revision.

e. General Criteria Revisions

The purpose of the revisions is to improve the clarity of the general criteria with regard to areas of chronic and acute toxicity allowed by permit, and to add protection against the effects of nutrient enrichment and for the protection of downstream uses. The revisions do not affect any risks to human health, public welfare or the environment since general criteria are expected to protect all waters at all times except when time-limited variances or permit allowances are made. Therefore, no uncertainties exist with respect to the revisions.

f. Antidegradation Implementation Procedure

This revision updates reference to Missouri's Antidegradation Implementation Procedure approved by the Missouri Clean Water Commission on July 13, 2016. No uncertainties or assumptions exist with respect to this revision as it is a simple update of a reference to an implementation procedure. Any risks to public health, welfare or the environment would be addressed in the development of the AIP itself and not the proposed rule reference revision.

g. Losing Stream Reference and Table J

The purpose of the revisions is to improve the accuracy and clarity of the rule. The revisions will also increase the accuracy and efficiency of decisions made using the most up-to-date losing stream information. These revisions do not significantly affect any risks to public health, welfare or the environment. No uncertainties or assumptions exist with respect to these revisions.

h. Remove Table K, Site-Specific Criteria

The proposed revision removes disapproved and expired site-specific criteria from rule and does not affect any risks to public health, welfare or the environment. No uncertainties or assumptions exist with respect to the revision.

i. Missouri Use Designation Dataset Update

The purpose of the revisions is to improve the accuracy and clarity of the rule. The revisions will also increase the accuracy and efficiency of decisions made using the most up-to-date water body information. This change did not significantly affect any risks to public health, welfare or the environment. No uncertainties or assumptions exist with respect to these revisions.

j. Section 304(a) Water Quality Criteria

This amendment proposes to revise state criteria to reflect the latest federal criteria developed under Section 304(a) of the federal Clean Water Act. Because the department is adopting federal standards for these revisions, further information on uncertainties and assumptions made during the risk assessment may be obtained by reviewing the administrative record created during EPA's development of technical guidelines and guidance for these pollutants.

k. Numeric Nutrient Criteria for Lakes

The central paradigm on which the rule is based – that the most commonly occurring water quality impairments in lakes and reservoirs result from loading of nitrogen and phosphorus in quantities that are significantly in excess of natural loading levels – is well established in the scientific literature. These impairments include but are not limited to: frequent nuisance algal blooms, fish kills, overabundance or decline of macrophytes, and loss of top predators from the food chain (US-EPA, 2000).

While the paradigm is well established, there is uncertainty about the degree of nutrient loading that will lead to impairment. A certain amount of nutrient concentration is desirable and necessary for the support of healthy aquatic ecosystems. There is no single nutrient concentration level that is appropriate for all lakes and reservoirs. Factors that affect threshold levels include the type of aquatic ecosystem in question, local geology, lake hydrology, turbidity resulting from sedimentation, and land cover.

The rule addresses these uncertainties by establishing numeric criteria for Chl-a (as a biological response to nutrient inputs) rather than calculating direct numeric criteria for TP and TN. This approach may allow a higher concentration for nitrogen and phosphorus if the lake is consistently in compliance with Chl-a criteria. The rule also delineates Chl-a criteria and nutrient screening values by ecoregion, and allows identification of those water bodies that merit more stringent protections than the others within each ecoregion.

l. Water Quality Standards Variances

The proposed rule revisions clarify existing state and federal variance procedures and incorporate by reference of Missouri's Multiple-Discharger Variance framework. These revisions do not significantly affect any risks to public health, welfare or the environment. No uncertainties or assumptions exist with respect to these revisions.

m. Miscellaneous Text Revisions

No uncertainties exist with respect to risk in making the proposed revisions as risk analyses are not relevant to revisions to internal text references, typographical errors or formatting.

13. <u>A description of any significant countervailing risks that may be caused by the proposed rule</u>

In addition to analyzing the risks to human health, public welfare, or the environment for the proposed rule, countervailing risks that may be caused by the proposed rule must also be analyzed. While many times countervailing risks may be minor or insignificant when compared to the risk being resolved by the rulemaking, there may be major countervailing risks that should be considered in a risk tradeoff analysis. It is in these cases where additional information or data may be necessary to fully characterize the risk/benefit of the proposed rulemaking. Descriptions of any significant countervailing risks that may be caused by the rulemaking are listed for each item:

a. Waters of the State Definition

There are no significant countervailing risks associated with making state regulation consistent with state statute.

b. Mixing Zones and Zones of Initial Dilution

There are no significant countervailing risks associated with making the clarifications to mixing zones and zones of initial dilution proposed by these revisions.

c. Hardness

There are no significant countervailing risks associated with revising the hardness definition and derivation methodology from a lower quartile (twenty-fifth percentile) to a median (fiftieth percentile) value.

d. pH

There are no significant countervailing risks associated with making clarifications to averaging period and toxicity conditions protected by the pH criteria.

e. General Criteria Revisions

There are no significant countervailing risks associated with making clarifications to toxicity and adding protections against the effects of nutrient enrichment and for the protection of downstream uses to the general criteria as proposed by these revisions.

f. Antidegradation Implementation Procedure

There are no significant countervailing risks associated with updating reference in rule to the approved AIP. To the contrary, without this change the risk to water quality may be significant as the department would not have approved antidegradation procedures in place.

g. Losing Stream Reference and Table J

There are no significant countervailing risks associated with the proposed rule revision to improve the accuracy and clarity of losing stream locations.

h. Remove Table K, Site-Specific Criteria

There are no significant countervailing risks associated with removing disapproved and expired site-specific criteria from rule.

i. Missouri Use Designation Dataset Update

There are no significant countervailing risks associated with the proposed rule revision to improve the accuracy and clarity of water body information.

j. Section 304(a) Water Quality Criteria

The application of new or revised Section 304(a) criteria may result in an increase or decrease in pollutant concentrations within waters of the state depending on the criteria. Existing aquatic habitats and human health are not expected to be affected by the change where new or revised criteria may be less stringent than currently found in rule. Full attainment of aquatic communities and human health is expected as the new or revised criteria were developed to be protective of these uses. No significant countervailing risks are expected for the proposed revisions.

k. Numeric Nutrient Criteria for Lakes

Because of the complexity of the nutrient issue, there may be some risk that, in a given water body, the proposed criteria may be too stringent to adequately support a desired aquatic ecosystem, or not stringent enough to provide protection for all of the lake's designated uses. The criteria were developed following months of analysis of long-term data. The expertise and experience behind this effort will serve to minimize this type of risk.

The proposed rule is likely to result in some point source facilities being required to add phosphorus control to their systems. It is possible that nitrogen control may be required in a few instances as well.

The addition or alteration of phosphorus removal systems to point source facilities will result in increased production of sludge, due to the flocculation that results from the addition of alum to the wastewater stream. It is expected that sludge disposal will only be a significant challenge at larger facilities.

l. Water Quality Standards Variances

There are no significant countervailing risks associated with the proposed rule revisions to clarify existing variance procedures and incorporate Missouri's MDV framework by reference.

m. Miscellaneous Text Revisions

No countervailing risks have been identified in association with the proposed revisions to update internal references, correct typographical errors and improve formatting.

14. <u>The identification of at least one, if any, alternative regulatory approaches that will produce comparable human health, public welfare or environmental outcomes.</u>

In most cases, the purpose of the proposed revision or addition is to make Missouri's WQS regulation at 10 CSR 20-7.031 functionally equivalent to federal standards. Because federal technical guidelines and guidance was available in most cases, and development of state-specific alternatives can be resource intensive, no other approaches or alternatives were considered. However, persons who believe another approach is available, and can be supported by sufficient science and rationale, are encouraged to submit an explanation of the alternative approach to the Department during the public comment period on the proposed rule.

The identification of at least one, if any, alternative regulatory approach that will produce comparable human health, public welfare or environmental outcome are listed for each proposed revision (where available):

a. Waters of the State Definition

State regulations must be consistent with the state statutes that are being implemented. As a result, no alternative regulatory approaches were identified that would produce comparable human health, public welfare or environmental outcomes.

b. Mixing Zones and Zones of Initial Dilution

States have some flexibility to establish mixing zones and zones of initial dilution for permitted discharges to its waters. The Department has not identified any alternative regulatory approaches that would produce comparable results to the clarifications proposed by the revisions. Inaction would lead to greater confusion and potential misapplication of the rule.

c. Hardness

This revision changes the hardness definition and derivation methodology to reflect the median (fiftieth percentile) hardness condition within a water body. This condition is expected to statistically occur roughly half the time given a normal distribution of the data. While alternate statistical endpoints could be chosen, the department has not identified any alternative regulatory approaches that would produce comparable results. Having the derivation methodology in the water quality standards provides clarity to the rule and its implementation.

d. pH

The department has not identified any alternative regulatory approaches that would produce comparable results to the clarification of the pH criteria proposed by the revisions. Alternate regulatory approaches such as effluent studies or site-specific criteria for effluent dominated discharges would be much more involved and resource intensive than the proposed regulatory clarification. Inaction would lead to greater confusion and potential misapplication of the rule.

e. General Criteria Revisions

The department has not identified any alternative regulatory approaches that would produce comparable results to the clarification and addition to general criteria proposed by the revisions. Inaction would lead to greater confusion and potential misapplication of the rule.

f. Antidegradation Implementation Procedure

This revision updates reference to Missouri's Antidegradation Implementation Procedure to be consistent and functionally equivalent to federal antidegradation requirements. The department has not identified any alternative regulatory approach that would allow for approval of the AIP by EPA.

g. Losing Stream Reference and Table J

The department has not identified any alternative regulatory approaches that would produce comparable results to the proposed revisions. The removal of static tables and replacing them with reference to up-to-date digital geospatial information is anticipated to have increased benefit compared to inaction.

h. Remove Table K, Site-Specific Criteria

The department has not identified any alternative regulatory approaches that would produce comparable results to the proposed revision. The removal of disapproved and expired site-specific criteria from rule will increase clarity in the rule regarding the status of these criteria.

i. Missouri Use Designation Dataset Update

The department has not identified any alternative regulatory approaches that would produce comparable results to the proposed revisions.

j. Section 304(a) Water Quality Criteria

State water quality standards must be functionally equivalent to federal standards. The department has not identified any alternative regulatory approaches that would produce comparable results to the changes proposed by these revisions. Therefore, no other approaches or alternatives to federal Section 304(a) numeric water quality criteria were considered.

k. Numeric Nutrient Criteria for Lakes

The most immediate alternative regulatory approach would be to establish direct regional numeric criteria for total nitrogen (TN) and total phosphorous (TP) in Missouri. The other viable alternative regulatory approach would be the adoption of EPA's national nutrient criteria. These numeric nutrient criteria are generally more stringent than what is in the proposed rule, as they employ a different regional delineation and do not account for the variability of existing uses in Missouri lakes.

l. Water Quality Standards Variances

The department has not identified any alternative regulatory approaches that would produce comparable results to the clarification of existing variance procedures and incorporate reference to Missouri's MDV framework. Inaction would lead to greater confusion and potential misapplication of the rule.

m. Miscellaneous Text Revisions

The proposed revisions to update internal references, correct typographical errors and improve formatting are the only reasonable alternative for addressing these errors.

15. Provide information on how to provide comments on the Regulatory Impact Report during the 60-day period before the proposed rule is filed with the Secretary of State

Regulatory Impact Reports for current rule developments of the Water Protection Program may be found on the program's Rule Development web page at: http://dnr.mo.gov/env/wpp/rules/wpp-rule-dev.htm

The Regulatory Impact Report provides information on rule development. Please provide comments in the time frame indicated. The comment period for this Regulatory Impact Report is September 23, 2016 to November 24, 2016.

Comments can be submitted by e-mail to John Hoke, john.hoke@dnr.mo.gov. E-mails must include the senders contact information (i.e. name, mailing address, telephone number) and reference the "2016 WQS Regulatory Impact Report".

Comments may also be sent by mail to:

John Hoke
Water Protection Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, Missouri 65102-0176

16. <u>Provide information on how to request a copy of comments or the web information where the comments will be located.</u>

Hard copies of received comments may be requested via telephone at (573) 751-5723. Web posting will be to the Water Protection Program's Rule Development web page, listed above.

References

General Rulemaking Documents

Missouri Rulemaking Manual, Missouri Secretary of State
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d. pH

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http://dnr.mo.gov/env/wpp/cwforum/docs/lake-numeric-nutrient-criteria-comment-letter.pdf

U.S. Environmental Protection Agency, Protection of Downstream Waters in Water Quality Standards: Frequently Asked Questions, (EPA-820-F-14-001), June 2014
http://www2.epa.gov/sites/production/files/2015-01/documents/downstream-faqs.pdf

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f. Antidegradation Implementation Procedure

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Letter, U.S. Environmental Protection Agency, Re: Antidegradation Implementation Methods (Idaho Docket Number 58-0102-1001), July 23, 2013
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j. Section 304(a) Water Quality Criteria

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Mulitple-Discharger Variance

m. Miscellaneous Text Revisions

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Appendix A

Table 1. Number of facilities potentially affected by Section 304(a) criteria revisions.

Category	Number of facilities
Site Specific	2676
General	1388
Stormwater	774
Underground Injection	3
Total Facilities	**4841**
Facilities Private/Public	
Private	3707
Public	1134
Expected limit change	
Increased limit	1376
Decreased limit	477
No change expected	4839

Table 2. Number of permitted facilities for each relevant Section 304(a) parameter.

Relevant 304(a) Parameter	Number of facilities
1,1,2-Trichloroethane	2
1,1-Dichloroethylene	3
1,2-Dichloroethane	3
1,2-Diphenylhydrazine	1
2,3,7,8-Tetrachlorodibenzo-p-dioxin 2,3,7,8-TCDD (Dioxin)	1
2,4,5-Trichlorophenol	1
2,4,6-Trichlorophenol	14
2,4-Dichlorophenol	1
2,4-Dimethylphenol	15
2,4-Dinitrophenol	14
2,4-Dinitrotoluene	1
2-Chlorophenol	14

Relevant 304(a) Parameter	Number of facilities
3,3'-Dichlorobenzidine	1
Acenaphthene	15
Acrylonitrile (2-propenenitrile)	1
Aldrin	1
Anthracene	3
Antimony	41
Arsenic	85
Barium	33
Benzene	61
Benzo-a-Anthracene	15
Benzo-a-Pyrene	16
Benzo-k-Fluoranthene	15
Beryllium	41
Bis(2-Chloroethyl) Ether	2
Bis(2-Ethylhexyl) Phthalate	3
Cadmium	115
Carbon Tetrachloride (Tetrachloromethane)	1
Chlordane	1
Chloride	117
Chlorine, Total Residual	1232
Chlorobenzene	1
Chromium (III)	95
Chromium (Total)	14
Chromium (VI)	107
Chrysene	15
Copper	383
Cyanide	50
Diazinon	1
Dibenzo-a-h-Anthracene	16
Dieldrin	1
Ethylbenzene	302
Fluoranthene	15
Fluorene	14
gamma-Hexachlorocyclohexane (gamma-BHC; Lindane)	1
Heptachlor	1
Hexachlorobenzene	1
Hexachlorobutadiene	1

Relevant 304(a) Parameter	Number of facilities
Hexachloroethane	1
Indeno(1,2,3-cd)Pyrene	16
Mercury	71
Methoxychlor	8
Methylene Chloride (Dichloromethane)	7
Nickel	91
Nitrobenzene	1
N-Nitrosodimethylamine	1
Oxygen, Dissolved	859
Parathion	1
Pentachlorophenol	16
pH	4604
Phenol	32
Polychlorinated Biphenyls (PCBs)	3
Pyrene	3
Selenium	60
Silver	67
Solids Suspended and Turbidity	4148
Sulfate	44
Temperature	1073
Tetrachloroethylene	4
Thallium	44
Toluene	59
Toxaphene	1
trans-1,2-Dichloroethylene	2
Trichloroethylene	10
Trichloromethane (Chloroform)	5
Vinyl Chloride	7
Zinc	399

Table 3. Assumptions for Unit Costs for CAPDETS analysis

Description	Value	Units
Building Cost	110	$/ft^2$
Excavation	8	$/yd^3$
Wall Concrete	650	$/yd^3$
Slab Concrete	350	$/yd^3$
Crane Rental	250	$/hr
Canopy Roof	20	$/ft^2$
Electricity	0.10	$/kWh
Hand Rail	75	$/ft
Land Costs	0	$/acre
Construction Labor Rate	40	$/hr
Operator Labor Rate	25	$/hr
Administration Labor Rate	20	$/hr
Laboratory Labor Rate	25	$/hr
Hydrated Lime [$Ca(OH)^2$]	0.18	$/lb
Interest Rate (Public facility)	1	%
Interest Rate (Private facility)	5	%
Construction Period	3	yr
Operating Life of Plane	20	yr
Engineering Design Fee	10	%
Miscellaneous	5	%
Administration/ Legal	2	%
Inspection	2	%
Contingency	10	%
Technical	2	%
Profit and Overhead	2	%
Structural Life	20	yr
Mechanical Life	20	yr
Pump Replacement	10	yr
Filter Replacement	10	yr
Distance to haul sludge	20	mi
Sludge disposal cost	125	$/yd^3$

Appendix B

Potential Candidates for the Multiple Discharger Variances

Municipality (owner)	Facility Name	Permit Number	Effective Date	HUC 8	Receiving Stream	First Classified Stream WBID	UTM Coordinates of Discharge Location (X,Y)
City of Advance	Advance WWTF	MO0126349	7/1/2014	08020204	Unnamed Tributary to Ditch #24	3074	(777283, 4110785)
City of Albany	Albany WWTF	MO0021466	11/1/2014	10280101	Town Branch	457	(385357, 4455797)
City of Jefferson	Algoa Regional WWTF	MO0044300	5/20/2011	10300102	Missouri River	701	(581833, 4267934)
City of Alma	Alma Sewage Treatment Lagoon	MO0048097	11/1/2015	10300104	Tributary Elm Branch	3960	(453589, 4327869)
City of Amazonia	Amazonia Lagoons	MO0126802	6/4/2010	10240011	Mace Cr.	267	(338539, 4417597)
City of Amsterdam	Amsterdam WWTF	MO0125091	9/1/2015	10290102	Tributary to Mulberry Creek	3960	(361789, 4244967)
City of Anniston	Anniston WWTP	MO0114928	9/16/2010	08020201	Spillway Ditch	3135	(828730, 4082650)
City of Arcadia	Arcadia East WWTF	MO0080667	4/1/2014	08020202	Unnamed Tributary to Stouts Creek #2	2893	(709906, 4163137)
City of Arcadia	Arcadia West WWTF	MO0050687	4/1/2014	08020202	Unnamed Tributary to Stouts Creek #2	2893	(709896, 4163135)
City of Armstrong	Armstrong WWTF	MO0093084	12/1/2015	10280203	Unnamed Tributary to Batts Creek	680	(524915, 4347593)
City of Asbury	Asbury WWTF	MO0114740	6/1/2016	11070207	Tributary to Spring River	3960	(359438, 4126530)
City of Ashland	Ashland Lagoons	MO0106844	2/1/2014	10300102	Tributary to Foster Branch	747	(564694, 4290768)
City of Bates City	Bates City WWTF	MO0128716	2/1/2016	10300101	Tributary to East Sni-a-bar Creek	3960	(409470, 4317938)
City of Bell City	Bell City WWTF	MO0080594	3/1/2014	08020204	Unnamed tributary to Ditch #30	3075	(782517, 4101876)
City of Bellflower	Bellflower WWTF	MO0103764	1/1/2016	07110008	Tributary to East Branch Brush Creek	3960	(643051, 4319127)
Village of Benton City	Benton City WWTF	MO0103021	8/1/2015	07110008	West Fork Cuivre River	3960	(607975, 4332035)
City of Benton	Benton WWTF	MO0055182	5/1/2013	08020204	Unnamed Tributary to Caney Cr.	3051	(806013, 4111924)
City of Bertrand	Bertrand WWTF	MO0100111	4/1/2014	08020201	Tributary to Ash Ditch	3142	(814945, 4090690)
City of Blackburn	Blackburn WWTF	MO0099678	1/1/2014	10300104	East Fork Elm Branch	899	(457769, 4330614)
City of Bland	Bland WWTF	MO0055395	4/1/2016	07140103	Tributary to Greedy Creek	3960	(619624, 4239296)
City of Blythedale	Blythedale WWTF	MO0123081	1/30/2009	10280101	Unnamed trib to East Fork Big Creek	447	(421166, 4480139)

City of Brashear	Brashear WWTF	MO0046990	12/1/2013	07110005	Unnamed Tributary to Hog Branch	110	(552515, 4443317)
City of Braymer	Braymer WWTF	MO0028061	12/1/2013	10280101	Unnamed Tributary to Mud Creek	538	(432618, 4383356)
City of Breckenridge	Breckenridge WWTF	MO0093891	5/1/2013	10280101	Tributary to Panther Creek	521	(430530, 4400383)
City of Bronaugh	Bronaugh WWTF	MO0120472	9/1/2015	10290104	Tributary to Little Dry Wood Creek	3960	(371101, 4173844)
City of Brunswick	Brunswick WWTF	MO0032557	7/1/2014	10280103	Grand River	593	(489916, 4362972)
City of Bucklin	Bucklin East WWTF	MO0085928	3/1/2014	10280202	Tributary to Van Dorsan Creek	670	(510442, 4402203)
City of Bucklin	Bucklin West WWTF	MO0085910	3/1/2014	10280103	Unnamed Tributary to Sights Branch	597	(508632, 4403653)
City of Bunceton	Bunceton WWTF	MO0055981	2/1/2016	10300102	Stephans Branch	3960	(517119, 4293436)
City of Cainesville	Cainesville WWTF	MO0122467	5/1/2015	10280102	Tributary to Brushy Creek	3960	(433976, 4476016)
Village of Cairo	Cairo WWTF	MO0103390	6/1/2013	07110006	Unnamed tribuarty to Mud Creek	128	(549375, 4374398)
Village of Caledonia	Caledonia WWTF	MO0128571	3/1/2015	07140104	Tributary to Goose Creek	2153	(695033, 4182606)
City of Callao	Callao WWTF	MO0114421	5/1/2013	10280203	Unnamed tributary to Middle Fork. of Chariton River	698	(533196, 4400995)
City of Campbell	Campbell WWTF	MO0022861	12/1/2013	08020204	Tributary to Main Ditch	3960	(763562, 4041729)
City of Canton	Canton Sewer Lagoon	MO0056278	6/1/2013	07110001	Unnamed Tributary to Mississippi R.	1	(626622, 4441421)
City of Center	Center WWTF	MO0107719	7/1/2016	07110007	Sugar Creek	3960	(628546, 4375669)
City of Centerview	Centerview WWTF	MO0106496	2/1/2015	10300104	Unnamed Tributary to Devil's Branch	928	(426415, 4289510)
City of Chilhowee	Chilhowee WWTF	MO0096091	6/26/2009	10290108	Unnamed Tributary to Norris Cr.	1252	(424264, 4270769)
City of Holts Summit	Choctaw Ridge Lagoon	MO0033910	6/1/2016	10300102	Tributary to Turkey Creek	3960	(575821, 4275554)
City of Chula	Chula WWTP	MO0091146	5/1/2013	10280103	Unnamed Tributary to Medicine Cr.	616	(459507, 4418720)
City of Clarksburg	Clarksburg WWTF	MO0109797	2/1/2016	10300102	Tributary to Long Branch	3960	(528222, 4278743)
City of Clarksdale	Clarksdale WWTF	MO0117161	1/1/2014	10240012	Little Third Fork Platte River	328	(367777, 4408385)
City of Clarksville	Clarksville WWTF	MO0039632	2/1/2014	07110004	Unnamed tributary to Mississippi River	3699	(681653, 4358616)
City of Coffey	Coffey WWTF	MO0117862	5/1/2014	10280101	Tributary to Little Cypress Creek	443	(413708, 4440074)

City of Collins	Collins WWTF	MO0103756	6/1/2015	10290106	Tributary to Coon Creek	3960	(444994, 4195061)
City of Conception Junction	Conception Junction	MO0104914	6/1/2013	10240012	Unnamed Tributary to Platte River	312	(355900, 4459301)
City of Concordia	Concordia Southeast WWTF	MO0025194	7/1/2013	10300104	Unnamed Tributary to Panther Creek	891	(454301, 4312006)
City of Conway	Conway WWTF	MO0031674	7/1/2015	10290110	Tributary to Jones Creek	3960	(515084, 4151167)
City of Corder	Corder North Lagoon	MO0022926	7/1/2014	10300104	Tributary to South Salt Fork	899	(445283, 4328956)
City of Corder	Corder South Lagoon	MO0022934	7/1/2014	10300104	Salt Fork	899	(444323, 4327043)
City of Cowgill	Cowgill WWTF	MO0130052	5/1/2015	10280101	Tributary to South Mud Creek	3960	(420608, 4378033)
City of Craig	Craig WWTF	MO0107042	4/1/2015	10240005	Old Channel Tarkio River	3960	(297370, 4451400)
City of Creighton	Creighton WWTF	MO0100102	5/1/2016	10290108	Knob Creek	3960	(406451, 4260617)
City of Dearborn	Dearborn WWTF	MO003251	3/1/2015	10240011	Bee Creek	273	(346917, 4376137)
City of Downing	Downing WWTF	MO0109240	7/1/2013	07110002	North Fabius River	56	(554133, 4482818)
Village of Eagleville	Eagleville WWTF	MO0113930	3/1/2014	10280101	Unnamed Tributary to East Fork Big Creek	447	(417255, 4479124)
City of Ellington	Ellington WWTF	MO0022896	9/1/2015	11010007	Tributary to Logan Creek	3960	(680616, 4123720)
City of Emma	Emma South WWTF	MO0028584	1/1/2014	10300104	Goose Creek	891	(457101, 4312772)
City of Ewing	Ewing WWTF	MO0104671	12/1/2014	07110002	Tributary to Middle Fabius River	63	(609649, 4430851)
City of Fairfax	Fairfax WWTF	MO0050601	6/1/2015	10240005	Tributary to Tarkio River	242	(296415, 4467398)
City of Festus	Festus Interim West WWTF	MO0122777	12/1/2014	07140101	Joachim Creek	1719	(725077, 4234807)
City of Freeburg	Freeburg WWTF	MO0058220	1/1/2014	10290203	Steuber Hollow Creek	3780	(594931, 4241243)
City of Gainesville	Gainesville WWTF	MO0027570	11/1/2013	11010006	Lick Creek	2572	(550653, 4050296)
City of Galt	Galt WWTP	MO0095729	5/1/2013	10280103	Unnamed Tributary to West Fork Medicine Creek	623	(467665, 4440553)
City of Garden City	Garden City WWTF	MO0046647	1/1/2016	10290108	Tributary to Panther Creek	3960	(397275, 4269140)
City of Gilman City	Gilman City WWTF	MO0098663	8/1/2013	10280102	Unnamed Tributary to Tombstone Creek	585	(426612, 4443837)
City of Glasgow	Glasgow WWTF	MO0034240	7/1/2013	10300102	Hurricane Creek	781	(512946, 4339921)
City of Graham	Graham WWTF	MO0094307	5/1/2015	10240010	Tributary to Elkhorn Creek	287	(327073, 4451917)
City of Grant City	Grant City West WWTF	MO0027600	6/1/2015	10280101	Tributary to Marlowe Creek	3960	(378585, 4481795)

City of Green Castle	Green Castle Lagoon	MO0103322	6/1/2013	10280202	Unnamed Tributary to Mussel Fork Creek	674	(510804, 4456060)
City of Green City	Green City WWTF	MO0112135	5/1/2013	10280202	Unnamed Tributary to Mussel Fork Creek	674	(505189, 4457101)
City of Green Ridge	Green Ridge Lagoon	MO0049654	12/1/2013	10300103	Tributary to Basin Fork	3960	(463908, 4275414)
City of Greentop	Greentop WWTF	MO0091642	7/1/2014	07110005	Unnamed Tributary to North Fork Salt River	3960	(538026, 4465403)
City of Greenville	Greenville WWTF	MO0093432	5/1/2013	08020202	Unnamed Tributary to St. Francis River	2835	(726464, 4111545)
City of Hamilton	Hamilton SE Municipal WWTF	MO0022071	6/9/2010	10280101	Cottonwood Creek	527	(414861, 4398013)
City of Hamilton	Hamilton SW Municipal WWTF	MO0022063	6/9/2010	10280101	Unnamed Tributary to Tom Creek	518	(413560, 4398780)
City of Hardin	Hardin WWTF	MO0046655	1/1/2014	10300101	Norborne Drainage System	369	(429128, 4347499)
City of Hayti	Hayti Aerated Lagoon	MO0057673	12/1/2013	08020204	Main Ditch #8	3031	(792039, 4017182)
City of Hermann	Hermann WWTF	MO0106585	4/1/2016	10300200	Tributary to Missouri River	1604	(637227, 4285469)
City of Higbee	Higbee WWTF	MO0093505	12/1/2014	10300102	Unnamed Tributary to Salt Fork	765	(541399, 4349473)
City of Higginsville	Higginsville I-70 N Lagoon	MO0023094	5/1/2013	10300104	Unnamed Tributary to Davis Creek	907	(436057, 4317677)
City of Higginsville	Higginsville I-70 S Lagoon	MO0111848	9/1/2013	10300104	Unnamed Tributary to Davis Creek	907	(437501, 4316635)
City of High Hill	High Hill WWTF	MO0102083	2/1/2014	10300200	Unnamed trib to Bear Creek	1627	(640839, 4303825)
City of Holcomb	Holcomb WWTF	MO0022331	12/9/2010	08020204	Main Ditch	3112	(767539, 4033097)
City of Holt	Holt Wastewater Lagoon	MO0109002	10/1/2015	10300101	Muddy Fork	3960	(383878, 4366732)
City of Hopkins	Hopkins WWTF	MO0054755	6/1/2013	10240013	Middle Fork 102 River	342	(345039, 4490331)
City of Houstonia	Houstonis Lagoon	MO0058475	6/1/2014	10300104	Buffalo Creek	3539	(469410, 4306016)
City of Hunnewell	Hunnewell WWTF	MO0084972	5/1/2014	07110004	South Fork North River	86	(598588, 4391973)
City of Iberia	Iberia WWTF	MO0101273	5/1/2016	10290111	Tributary to Rabbithead Creek	3960	(561639, 4216869)
City of Ionia	Ionia WWTF	MO0130028	2/16/2011	10300103	Trib. to S. Flat Cr.	3300	(471819, 4261186)
Village of Jameson	Jameson WWTF	MO0118010	8/1/2015	10280101	Tributary to Big Muddy Creek	3960	(416241, 4428931)

City of Jamestown	Jamestown North WWTF	MO0057410	1/1/2015	10300102	Unnamed Tributary to Factory Creek	804	(545087, 4291274)
City of Jamestown	Jamestown South WWTF	MO0058203	1/1/2015	10300102	Unnamed Tributary to Haldiman Branch	807	(545495, 4290464)
City of Jonesburg	Jonesburg WWTF	MO0040851	1/1/2014	07110008	Unnamed Tributary to Little Bear Creek	194	(647131, 4303005)
City of King City	King City Lagoon	MO0049662	12/1/2015	10240012	Tributary to Little Third Fork	3960	(370696, 4432722)
City of Kingdom City	Kingdom City Lagoon	MO0127370	7/1/2013	10300102	Unnamed Tributary to McKinney Creek	713	(592770, 4311437)
City of Kingsville	Kingsville Wastewater Stabilization Lagoon	MO0025844	1/1/2014	10290108	Unnamed Tributary to Big Creek	1250	(406692, 4288123)
City of LaBelle	LaBelle WWTF	MO0100684	11/25/2009	07110002	Unnamed trib to Reddish Branch	63	(592229, 4442735)
City of La Monte	La Monte Northwest Lagoon	MO0108090	6/1/2015	10300104	South Fork Blackwater River	3960	(462485, 4292261)
City of La Monte	La Monte Southeast Lagoon	MO0108081	1/24/2011	10300103	Unnamed Tributary to Tributary to Muddy Creek	3499	(463858, 4290850)
City of Lancaster	Lancaster WWTF	MO0039691	5/1/2016	07110002	Tributary to North Fork Middle Fabius	3960	(541855, 4485240)
City of Laredo	Laredo WWTF	MO0094692	5/1/2013	10280103	Unnamed Tributary to Black Oak Branch	616	(462393, 4432640)
City of Lathrop	Lathrop Lagoon	MO0112704	7/1/2013	10280101	Shoal Creek	528	(386914, 4379769)
City of Lawson	Lawson WWTF	MO0091031	6/1/2016	10300101	Brushy Creek	3960	(395433, 4367075)
City of Lewistown	Lewistown WWTF	MO0120570	1/1/2014	7110002	Middle Fabius R.	63	(601225, 4439181)
City of Liberal	Liberal WWTF	MO0045837	4/1/2016	10290104	Tributary to Bitter Creek	3960	(366259, 4159079)
City of Linneus	Linneus WWTF	MO0093491	11/1/2013	10280103	Unnamed tributary to Muddy Creek	3769	(484689, 4412968)
Village of Livonia	Livonia WWTF	MO0121916	9/1/2013	10280201	Old Channel Chariton River	649	(526189, 4482073)
City of Lockwood	Lockwood WWTF	MO0030473	8/1/2015	10290106	Horse Creek	3960	(414120, 4138134)
Village of Ludlow	Ludlow WWTF	MO0130869	5/1/2015	10280101	Tributary to Shoal Creek Ditch	3960	(440120, 4390033)
Village of Luray	Luray WWTF	MO0129682	2/1/2015	7110001	Unnamed Tributary to South Linn Creek	41	(595539, 4478459)

City of Malta Bend	Malta Bend WWTF	MO0094404	5/1/2013	10300104	Unnamed Tributary to Salt Fork	899	(469415, 4336924)
City of Marble Hill	Marble Hill WWTF	MO0109762	5/1/2013	07140107	Opossum Creek	2269	(768583, 4131669)
City of Mayview	Mayview Lagoon	MO0055131	2/1/2015	10300101	Tabo Creek	406	(428516, 4323696)
City of Memphis	Memphis Municipal WWTF	MO0041173	4/1/2011	07110002	North Fabius River	56	(571902, 4477414)
City of Mendon	Mendon WWTF	MO0094714	8/1/2015	10280103	Hickory Branch	596	(487810, 4381402)
City of Mercer	Mercer WWTF	MO0056057	3/1/2014	10280102	Unnamed Tributary to Muddy Creek	557	(455888, 4484084)
City of Miller	Miller WWTF	MO0041149	9/1/2013	11070207	Unnamed Tributary to Stahl Creek	3176	(424627, 4118448)
City of Mindenmines	Mindenmines WWTF	MO0116581	6/1/2013	11070207	Glendale Fork	3202	(360721, 4147783)
City of Miner	Miner WWTF	MO0095133	8/1/2013	08020201	North Cut Ditch	3143	(809650, 4086942)
City of Morehouse	Morehouse WWTF	MO0030821	11/20/2009	08020204	Tributary to Old Channel Little River	3041	(794108, 4082729)
City of Morley	Morley WWTF	MO0126195	7/1/2014	08020201	St. Johns Ditch	3138	(803254, 4105702)
City of Morrison	Morrison WWTF	MO0119016	9/1/2013	10300102	Baileys Creek	842	(618272, 4281405)
City of Moscow Mills	Moscow Mills Municipal WWTF	MO0119709	3/1/2014	07110008	Cuivre River	152	(680155, 4314088)
City of New Cambria	New Cambria WWTF	MO0094706	7/1/2014	10280202	Puzzle Creek	666	(520451, 4401850)
City of New Hampton	New Hampton WWTF	MO0114685	5/1/2013	10280101	Sampson Creek	455	(398236, 4457231)
City of New London	New London WWTF	MO0092975	4/1/2016	7110007	Tributary to Salt River	3960	(637474, 4384346)
City of Newtown	Newtown WWTF	MO0117871	9/1/2013	10280103	Medicine Creek	619	(471734, 4468242)
City of Norborne	Norborne WWTF	MO0030791	2/1/2014	10300101	Moss Creek	369	(441445, 4348279)
Village of Novelty	Novelty WWTF	MO0102032	2/1/2014	07110004	North River	83	(568578, 4429466)
City of Novinger	Novinger WWTF	MO0056987	5/1/2013	10280202	Spring Creek	657	(524462, 4452838)
City of Odessa	Odessa Southwest Lagoon	MO0026395	1/1/2014	10300101	Tributary to East Fork Sni-a-bar	3441	(414694, 4315854)
City of Old Monroe	Old Monroe Wastewater Treatment Lagoon	MO0114359	1/8/2010	07110008	Tributary to Argent Slough	151	(695395, 4312849)
City of Orrick	Orrick Municipal Lagoon	MO0022918	11/1/2013	10300101	Keeney Creek	384	(403176, 4339141)
City of Otterville	Otterville WWTF	MO0101125	4/1/2014	10300103	Lamine River	847	(500671, 4283288)

City of Pacific	Pacific WWTP	MO0041131	11/26/2008	07140102	Meramec River	1841	(696277, 4257839)
City of Parma	Parma WWTF	MO0039900	5/1/2013	08020204	Unnamed Tributary to Ditch #8	3094	(784563, 4057993)
City of Perry	Perry WWTF	MO0111821	3/1/2014	07110007	Triubutary to Lick Creek	3960	(614055, 4366145)
City of Pilot Grove	Pilot Grove East WWTF	MO0093076	12/1/2014	10300102	Unnamed Tributary to Petite Saline Creek	786	(508697, 4302337)
City of Pilot Grove	Pilot Grove West WWTF	MO0093068	3/1/2014	10300103	Lamine River	847	(507183, 4303275)
City of Purdin	Purdin WWTF	MO0125831	2/1/2016	10280103	Tributary to Locust Creek	3960	(483901, 4423006)
City of Puxico	Puxico WWTF	MO0055158	5/1/2014	08020203	Turkey Creek	2985	(752378, 4092539)
City of Queen City	Queen City WWTF	MO0093785	5/1/2013	07110005	North Fork Salt River	113	(538520, 4472975)
City of Ravenwood	Ravenwood WWTF	MO0021458	7/1/2015	10240012	Tributary to Platte River	3960	(357099, 4468227)
Village of Rhineland	Rhineland WWTF	MO0117013	3/1/2015	10300200	Modoc Creek	3821	(629220, 4286449)
City of Ridgeway	Ridgeway West Lagoon	MO0048224	1/1/2015	10280101	East Fork Big Creek	446	(419730, 4469365)
City of Risco	Risco Municipal WWTF	MO0025852	4/1/2014	08020204	Ditch #8	3094	(784034, 4041947)
City of Rockville	Rockville WWTP	MO0103748	4/1/2013	10290105	HS Truman Lake	7207	(405619, 4213163)
City of Rosebud	Rosebud North Lagoon	MO0091367	3/1/2016	10300200	City of Boeuf Creek	3960	(639700, 4250663)
City of Rosebud	Rosebud South Lagoon	MO0091375	9/1/2015	07140103	Tributary to Soap Creek	3960	(639156, 4249142)
City of Salisbury	Salisbury 6 Acre Lagoon	MO0025313	2/1/2014	10280203	Unnamed Tributary to Middle Fork Chariton River	691	(518127, 4362235)
City of Sarcoxie	Sarcoxie WWTF	MO0028657	9/1/2015	11070207	Tributary to Center Creek	3960	(400806, 4103633)
City of Scott City	Scott City WWTF	MO0103594	3/1/2014	07140105	Unnamed Tributary to Dorrity Creek	3701	(811423, 4125812)
City of Senath	Senath WWTF	MO0048666	4/1/2014	08020204	Pole Cat Slough	3120	(755765, 4001445)
City of Sheldon	Sheldon WWTF	MO0040177	7/1/2013	10290105	Unnamed tributary to Little Clear Creek	1337	(386809, 4168919)
City of Smithton	Smithton WWTF	MO0025828	2/1/2015	10300103	Tributary to Flat Creek	3960	(491323, 4280836)
City of Spickard	Spickard WWTF	MO0113026	12/1/2013	10280102	Unnamed Tributary to Weldon River	560	(449575, 4455970)
City of Steele	Steele Aerated Lagoon	MO0057444	3/27/2009	08020204	Ditch #6	3022	(782217, 3998705)
City of Sturgeon	Sturgeon WWTF	MO0052027	6/1/2013	07110006	Reese Fork	136	(562804, 4343410)
City of Sumner	Sumner WWTF	MO0091600	2/1/2014	10280103	Grand River	593	(480228, 4390420)

City of Sweet Springs	Sweet Springs WWTF	MO0054518	6/1/2013	10300104	Unnamed trib to Davis Creek	907	(463243, 4314094)
City of Syracuse	Syracuse WWTF	MO0120111	9/1/2013	10300103	Otter Creek	887	(510190, 4280361)
City of Tarkio	Tarkio WWTF	MO0051608	1/1/2014	10240005	Tarkio River	242	(298678, 4477683)
City of Trimble	Trimble WWTF	MO0113751	6/1/2015	10240012	Dick's Creek	3960	(364205, 4369146)
Village of Truxton	Truxton WWTF	MO0118192	3/1/2014	07110008	Bear Creek	193	(652292, 4318917)
City of Union Star	Union Star Sewage WWTF	MO0096202	5/1/2015	10240012	Tributary to Third Fork Platte River	3960	(364091, 4425699)
City of Urbana	Urbana WWTF	MO0095176	2/1/2014	10290110	East Branch of Cahoochie Creek	1195	(485530, 4188837)
Village of Utica	Utica WWTF	MO0125679	4/1/2015	10280101	Tributary to Wolf Creek	3960	(447022, 4399425)
Village of Vanduser	Vanduser WWTF	MO0122599	9/27/2010	08020204	Old Chanel Little River	3041	(793223, 4098656)
City of Viburnum	Viburnum Wastewater Treatment Lagoon	MO0055751	4/14/2010	07140102	Indian Creek	3960	(666062, 4175433)
City of Vienna	Vienna WWTF	MO0055352	7/1/2013	10290111	Fly Creek	1090	(591092, 4227972)
Village of Fountain 'N Lakes	Village of Fountain N' Lake WWTF	MO0126101	6/1/2015	07110004	Tributary to Bob's Creek	35	(686136, 4315887)
Village of Kelso	Village of Kelso WWTF	MO0115118	6/1/2013	07140107	Unnamed Tributary to Ramsey Creek	2346	(806708, 4120741)
City of Weaubleau	Weaubleau WWTF	MO0040860	4/1/2011	10290105	Unnamed Tributary to Possum Hollow	3319	(451527, 4193806)
City of Wellington	Wellington WWTF	MO0041165	2/1/2014	10300101	Sni-a-bar Creek	399	(414904, 4330356)
City of Weston	Weston WTP	MOG640117	2/1/2014	10240011	Bear Creek	226	(336439, 4362252)
City of Wheeling	Wheeling WWTF	MO0097608	6/1/2013	10280103	Parson Creek	614	(467562, 4404080)
City of Williamsville	Williamsville WWTF	MO0090654	7/1/2013	11010007	Tributary to Williams Creek	2785	(718249, 4093930)

Public and private estimated total capital costs and total annual O&M costs by watershed using 8-digit hydrologic unit codes (HUC). Watersheds not represented in the tables below do not have facilities discharging to lake watersheds affected by the proposed rule.

Appendix C

Public Facilities

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
All	DF≤0.05	90	Low	$101,950,000	$10,530,000	$112,480,000
			High	$163,280,000	$16,125,000	$179,405,000
	0.05<DF≤1	111	Low	$184,840,000	$16,167,000	$201,007,000
			High	$349,270,000	$30,346,000	$379,616,000
	1<DF≤20	23	Low	$152,650,000	$11,288,000	$163,938,000
			High	$281,920,000	$19,500,000	$301,420,000
	DF>20	1	Low	$70,200,000	$4,350,000	$74,550,000
			High	$94,500,000	$4,880,000	$99,380,000
	Totals	**225**	**Low**	**$509,640,000**	**$42,335,000**	**$551,975,000**
			High	**$888,970,000**	**$70,851,000**	**$959,821,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110001 Bear - Wyaconda	DF≤0.05	0	Low	$0	$0	$0
			High	$0	$0	$0
	0.05<DF≤1	1	Low	$2,110,000	$180,000	$2,290,000
			High	$4,360,000	$381,000	$4,741,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$2,110,000**	**$180,000**	**$2,290,000**
			High	**$4,360,000**	**$381,000**	**$4,741,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110005 North Fork Salt	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	6	Low	$9,250,000	$821,000	$10,071,000
			High	$17,810,000	$1,639,000	$19,449,000
	1<DF≤20	1	Low	$8,280,000	$572,000	$8,852,000
			High	$16,700,000	$1,120,000	$17,820,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**8**	**Low**	**$18,620,000**	**$1,510,000**	**$20,130,000**
			High	**$36,040,000**	**$2,922,000**	**$38,962,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110006 South Fork Salt	DF≤0.05	5	Low	$5,800,000	$585,000	$6,385,000
			High	$10,100,000	$995,000	$11,095,000
	0.05<DF≤1	6	Low	$9,280,000	$818,000	$10,098,000
			High	$18,300,000	$1,680,000	$19,980,000
	1<DF≤20	3	Low	$19,980,000	$1,478,000	$21,458,000
			High	$41,100,000	$2,934,000	$44,034,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**14**	**Low**	**$35,060,000**	**$2,881,000**	**$37,941,000**
			High	**$69,500,000**	**$5,609,000**	**$75,109,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110007 Salt	DF≤0.05	1	Low	$1,160,000	$117,000	$1,277,000
			High	$2,020,000	$199,000	$2,219,000
	0.05<DF≤1	2	Low	$2,640,000	$242,000	$2,882,000
			High	$4,820,000	$462,000	$5,282,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**3**	**Low**	**$3,800,000**	**$359,000**	**$4,159,000**
			High	**$6,840,000**	**$661,000**	**$7,501,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110009 Peruque - Piasa	DF≤0.05	3	Low	$3,480,000	$351,000	$3,831,000
			High	$6,060,000	$597,000	$6,657,000
	0.05<DF≤1	1	Low	$2,110,000	$180,000	$2,290,000
			High	$4,360,000	$381,000	$4,741,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**4**	**Low**	**$5,590,000**	**$531,000**	**$6,121,000**
			High	**$10,420,000**	**$978,000**	**$11,398,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07140104 Big	DF≤0.05	3	Low	$3,410,000	$351,000	$3,761,000
			High	$5,570,000	$561,000	$6,131,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**3**	**Low**	**$3,410,000**	**$351,000**	**$3,761,000**
			High	**$5,570,000**	**$561,000**	**$6,131,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
08020202 Upper St Francis	DF≤0.05	3	Low	$3,410,000	$351,000	$3,761,000
			High	$5,570,000	$561,000	$6,131,000
	0.05<DF≤1	6	Low	$10,000,000	$879,000	$10,879,000
			High	$18,910,000	1,737,000	$20,647,000
	1<DF≤20	2	Low	$10,470,000	$815,000	$11,285,000
			High	$21,320,000	$1,624,000	$22,944,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**11**	**Low**	**$23,880,000**	**$2,045,000**	**$25,925,000**
			High	**$45,800,000**	**$3,922,000**	**$49,722,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10240012 Platte	DF≤0.05	0	Low	$0	$0	$0
			High	$0	$0	$0
	0.05<DF≤1	1	Low	$1,720,000	$149,000	$1,869,000
			High	$3,490,000	$315,000	$3,805,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,720,000**	**$149,000**	**$1,869,000**
			High	**$3,490,000**	**$315,000**	**$3,805,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10280101 Upper Grand	DF≤0.05	0	Low	$0	$0	$0
			High	$0	$0	$0
	0.05<DF≤1	1	Low	$1,510,000	$132,000	$1,642,000
			High	$3,040,000	$279,000	$3,319,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,510,000**	**$132,000**	**$1,642,000**
			High	**$3,040,000**	**$279,000**	**$3,319,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10280203 Little Chariton	DF≤0.05	3	Low	$3,480,000	$351,000	$3,831,000
			High	$6,060,000	$597,000	$6,657,000
	0.05<DF≤1	2	Low	$3,230,000	$281,000	$3,511,000
			High	$6,530,000	$594,000	$7,124,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**5**	**Low**	**$6,710,000**	**$632,000**	**$7,342,000**
			High	**$12,590,000**	**$1,191,000**	**$13,781,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290102 Lower Marais de Cygnes	DF≤0.05	3	Low	$3,480,000	$351,000	$3,831,000
			High	$6,060,000	$597,000	$6,657,000
	0.05<DF≤1	1	Low	$1,720,000	$149,000	$1,869,000
			High	$3,490,000	$315,000	$3,805,000
	1<DF≤20	1	Low	$4,620,000	$362,000	$4,982,000
			High	$9,120,000	$717,000	$9,837,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**5**	**Low**	**$9,820,000**	**$862,000**	**$10,682,000**
			High	**$18,670,000**	**$1,629,000**	**$20,299,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290104 Marmaton	DF≤0.05	1	Low	$1,160,000	$117,000	$1,277,000
			High	$2,020,000	$199,000	$2,219,000
	0.05<DF≤1	1	Low	$1,320,000	$121,000	$1,441,000
			High	$2,410,000	$231,000	$2,641,000
	1<DF≤20	1	Low	$4,620,000	$362,000	$4,982,000
			High	$9,120,000	$717,000	$9,837,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**3**	**Low**	**$7,100,000**	**$600,000**	**$7,700,000**
			High	**$13,550,000**	**$1,147,000**	**$14,697,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290105 Harry S Truman Reservoir	DF≤0.05	3	Low	$3,410,000	$351,000	$3,761,000
			High	$5,570,000	$561,000	$6,131,000
	0.05<DF≤1	7	Low	$12,510,000	$1,088,000	$13,598,000
			High	$24,060,000	$2,184,000	$26,244,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**10**	**Low**	**$15,920,000**	**$1,439,000**	**$17,359,000**
			High	**$29,630,000**	**$2,745,000**	**$32,375,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290106 Sac	DF≤0.05	12	Low	$13,360,000	$1,404,000	$14,764,000
			High	$20,320,000	$2,100,000	$22,420,000
	0.05<DF≤1	10	Low	$15,620,000	$1,372,000	$16,992,000
			High	$30,700,000	$2,814,000	$33,514,000
	1<DF≤20	2	Low	$19,980,000	$1,413,000	$21,393,000
			High	$41,600,000	$2,730,000	$44,330,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**24**	**Low**	**$48,960,000**	**$4,189,000**	**$53,149,000**
			High	**$92,620,000**	**$7,644,000**	**$100,264,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290107 Pomme de Terre	DF≤0.05	6	Low	$6,680,000	$702,000	$7,382,000
			High	$10,160,000	$1,050,000	$11,210,000
	0.05<DF≤1	5	Low	$8,560,000	$745,000	$9,305,000
			High	$16,900,000	$1,522,000	$18,422,000
	1<DF≤20	1	Low	$5,850,000	$453,000	$6,303,000
			High	$12,200,000	$907,000	$13,107,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**12**	**Low**	**$21,090,000**	**$1,900,000**	**$22,990,000**
			High	**$39,260,000**	**$3,479,000**	**$42,739,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290108 South Grand	DF≤0.05	6	Low	$6,890,000	$702,000	$7,592,000
			High	$11,630,000	$1,158,000	$12,788,000
	0.05<DF≤1	16	Low	$25,640,000	$2,260,000	$27,900,000
			High	$49,560,000	$4,560,000	$54,120,000
	1<DF≤20	3	Low	$16,320,000	$1,268,000	$17,588,000
			High	$33,520,000	$2,531,000	$36,051,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**25**	**Low**	**$48,850,000**	**$4,230,000**	**$53,080,000**
			High	**$94,710,000**	**$8,249,000**	**$102,959,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290109 Lake of the Ozarks	DF≤0.05	15	Low	$16,910,000	$1,755,000	$18,665,000
			High	$26,870,000	$2,733,000	$29,603,000
	0.05<DF≤1	6	Low	$10,310,000	$891,000	$11,201,000
			High	$20,880,000	$1,878,000	$22,758,000
	1<DF≤20	1	Low	$5,850,000	$453,000	$6,303,000
			High	$12,200,000	$907,000	$13,107,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**22**	**Low**	**$33,070,000**	**$3,099,000**	**$36,169,000**
			High	**$59,950,000**	**$5,518,000**	**$65,468,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290110 Niangua	DF≤0.05	5	Low	$5,730,000	$585,000	$6,315,000
			High	$9,610,000	$959,000	$10,569,000
	0.05<DF≤1	5	Low	$8,120,000	$711,000	$8,831,000
			High	$16,030,000	$1,456,000	$17,486,000
	1<DF≤20	1	Low	$4,620,000	$362,000	$4,982,000
			High	$9,120,000	$717,000	$9,837,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**11**	**Low**	**$18,470,000**	**$1,658,000**	**$20,128,000**
			High	**$34,760,000**	**$3,132,000**	**$37,892,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10300101 Lower Missouri – Crooked	DF≤0.05	3	Low	$3,410,000	$351,000	$3,761,000
			High	$5,570,000	$561,000	$6,131,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**3**	**Low**	**$3,410,000**	**$351,000**	**$3,761,000**
			High	**$5,570,000**	**$561,000**	**$6,131,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10300104 Blackwater	DF≤0.05	0	Low	$0	$0	$0
			High	$0	$0	$0
	0.05<DF≤1	1	Low	$1,720,000	$149,000	$1,869,000
			High	$3,490,000	$315,000	$3,805,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,720,000**	**$149,000**	**$1,869,000**
			High	**$3,490,000**	**$315,000**	**$3,805,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010001 Beaver Reservoir	DF≤0.05	7	Low	$7,770,000	$819,000	$8,589,000
			High	$10,900,000	$898,000	$11,798,000
	0.05<DF≤1	2	Low	$3,430,000	$301,000	$3,731,000
			High	$5,600,000	$361,000	$5,961,000
	1<DF≤20		Low	$0	$0	$0
			High	$0	$0	$0
	DF>20		Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**9**	**Low**	**$11,200,000**	**$1,120,000**	**$12,320,000**
			High	**$16,500,000**	**$1,259,000**	**$17,759,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010002 James	DF≤0.05	4	Low	$4,500,000	$468,000	$4,968,000
			High	$6,250,000	$514,000	$7,034,000
	0.05<DF≤1	15	Low	$26,700,000	$2,317,000	$29,017,000
			High	$42,140,000	$2,726,000	$44,866,000
	1<DF≤20	3	Low	$18,750,000	$1,387,000	$20,137,000
			High	$26,120,000	$1,552,000	$27,672,000
	DF>20	1	Low	$70,200,000	$4,350,000	$74,550,000
			High	$94,500,000	$4,880,000	$99,380,000
	Totals	**23**	**Low**	**$120,150,000**	**$8,522,000**	**$128,672,000**
			High	**$169,280,000**	**$9,672,000**	**$178,952,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010003 Bull Shoals Lake	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	7	Low	$14,080,000	$1,229,000	$15,309,000
			High	$25,710,000	$2,103,000	$27,813,000
	1<DF≤20	3	Low	$27,460,000	$1,910,000	$29,370,000
			High	$37,600,000	$2,137,000	$39,737,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**11**	**Low**	**$42,630,000**	**$3,256,000**	**$45,886,000**
			High	**$64,840,000**	**$4,403,000**	**$69,243,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010006 North Fork White	DF≤0.05	1	Low	$1,160,000	$117,000	$1,277,000
			High	$2,020,000	$199,000	$2,219,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,160,000**	**$117,000**	**$1,277,000**
			High	**$2,020,000**	**$199,000**	**$2,219,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010007 Upper Black	DF≤0.05	1	Low	$1,160,000	$117,000	$1,277,000
			High	$2,020,000	$199,000	$2,219,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,160,000**	**$117,000**	**$1,277,000**
			High	**$2,020,000**	**$199,000**	**$2,219,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11070207 Spring	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	4	Low	$6,270,000	$551,000	$6,821,000
			High	$12,430,000	$1,140,000	$13,750,000
	1<DF≤20	1	Low	$5,850,000	$453,000	$6,303,000
			High	$12,200,000	$907,000	$13,107,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**6**	**Low**	**$13,210,000**	**$1,121,000**	**$14,331,000**
			High	**$26,160,000**	**$2,210,000**	**$28,370,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11070208 Elk	DF≤0.05	2	Low	$2,320,000	$234,000	$2,554,000
			High	$4,040,000	$398,000	$4,438,000
	0.05<DF≤1	4	Low	$6,990,000	$601,000	$7,591,000
			High	$14,250,000	$1,273,000	$15,523,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**6**	**Low**	**$9,310,000**	**$835,000**	**$10,145,000**
			High	**$18,290,000**	**$1,671,000**	**$19,961,000**

Private Facilities

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
All	DF≤0.05	749	Low	$832,370,000	$87,633,000	$920,003,000
			High	$1,233,830,000	$121,405,000	$1,355,235,000
	0.05<DF≤1	46	Low	$69,360,000	$6,160,000	$75,520,000
			High	$126,040,000	$10,691,000	$136,731,000
	1<DF≤20	3	Low	$25,740,000	$1,834,000	$27,574,000
			High	$35,480,000	$2,048,000	$37,528,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**798**	**Low**	**$927,470,000**	**$95,627,000**	**$1,023,097,000**
			High	**$1,395,350,000**	**$134,144,000**	**$1,529,494,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110005 North Fork Salt	DF≤0.05	3	Low	$3,340,000	$351,000	$3,691,000
			High	$5,080,000	$525,000	$5,605,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**3**	**Low**	**$3,340,000**	**$351,000**	**$3,691,000**
			High	**$5,080,000**	**$525,000**	**$5,605,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110006 South Fork Salt	DF≤0.05	18	Low	$20,320,000	$2,106,000	$22,426,000
			High	$32,440,000	$3,294,000	$35,734,000
	0.05<DF≤1	1	Low	$1,510,000	$132,000	$1,642,000
			High	$3,040,000	$279,000	$3,319,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**19**	**Low**	**$21,830,000**	**$2,238,000**	**$24,068,000**
			High	**$35,480,000**	**$3,573,000**	**$39,053,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110007 Salt	DF≤0.05	2	Low	$2,250,000	$234,000	$2,484,000
			High	$3,550,000	$362,000	$3,912,000
	0.05<DF≤1	1	Low	$1,320,000	$121,000	$1,441,000
			High	$2,410,000	$231,000	$2,641,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**3**	**Low**	**$3,570,000**	**$355,000**	**$3,925,000**
			High	**$5,960,000**	**$593,000**	**$6,553,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110008 Cuivre	DF≤0.05	1	Low	$1,160,000	$117,000	$1,277,000
			High	$2,020,000	$199,000	$2,219,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,160,000**	**$117,000**	**$1,277,000**
			High	**$2,020,000**	**$199,000**	**$2,219,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07110009 Peruque – Piasa	DF≤0.05	3	Low	$3,340,000	$351,000	$3,691,000
			High	$5,080,000	$525,000	$5,605,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**3**	**Low**	**$3,340,000**	**$351,000**	**$3,691,000**
			High	**$5,080,000**	**$525,000**	**$5,605,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07140101 Cahokia – Joachim	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,090,000**	**$117,000**	**$1,207,000**
			High	**$1,530,000**	**$163,000**	**$1,693,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07140102 Meramec	DF≤0.05	2	Low	$2,250,000	$234,000	$2,484,000
			High	$3,550,000	$362,000	$3,912,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**2**	**Low**	**$2,250,000**	**$234,000**	**$2,484,000**
			High	**$3,550,000**	**$362,000**	**$3,912,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07140103 Bourbeuse	DF≤0.05	1	Low	$1,160,000	$117,000	$1,277,000
			High	$2,020,000	$199,000	$2,219,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,160,000**	**$117,000**	**$1,277,000**
			High	**$2,020,000**	**$199,000**	**$2,219,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
07140104 Big	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,090,000**	**$117,000**	**$1,207,000**
			High	**$1,530,000**	**$163,000**	**$1,693,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
08020202 Upper St Francis	DF≤0.05	22	Low	$24,330,000	$2,574,000	$26,904,000
			High	$36,110,000	3,766,000	$39,876,000
	0.05<DF≤1	1	Low	$1,720,000	$149,000	$1,869,000
			High	$3,490,000	$315,000	$3,805,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**23**	**Low**	**$26,050,000**	**$2,723,000**	**$28,773,000**
			High	**$39,600,000**	**$4,081,000**	**$43,681,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10240012 Platte	DF≤0.05	2	Low	$2,250,000	$234,000	$2,484,000
			High	$3,550,000	$362,000	$3,912,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**2**	**Low**	**$2,250,000**	**$234,000**	**$2,484,000**
			High	**$3,550,000**	**$362,000**	**$3,912,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10280102 Thompson	DF≤0.05	0	Low	$0	$0	$0
			High	$0	$0	$0
	0.05<DF≤1	1	Low	$1,510,000	$132,000	$1,642,000
			High	$3,040,000	$279,000	$3,319,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,510,000**	**$132,000**	**$1,642,000**
			High	**$3,040,000**	**$279,000**	**$3,319,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10280103 Lower Grand	DF≤0.05	0	Low	$0	$0	$0
			High	$0	$0	$0
	0.05<DF≤1	1	Low	$1,510,000	$132,000	$1,642,000
			High	$3,040,000	$279,000	$3,319,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,510,000**	**$132,000**	**$1,642,000**
			High	**$3,040,000**	**$279,000**	**$3,319,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10280203 Little Chariton	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,090,000**	**$117,000**	**$1,207,000**
			High	**$1,530,000**	**$163,000**	**$1,693,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290102 Lower Marais des Cygnes	DF≤0.05	2	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**2**	**Low**	**$1,090,000**	**$117,000**	**$1,207,000**
			High	**$1,530,000**	**$163,000**	**$1,693,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290104 Marmaton	DF≤0.05	2	Low	$2,180,000	$234,000	$2,414,000
			High	$3,060,000	$326,000	$3,386,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**2**	**Low**	**$2,180,000**	**$234,000**	**$2,414,000**
			High	**$3,060,000**	**$326,000**	**$3,386,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290105 Harry S Truman Reservoir	DF≤0.05	10	Low	$11,040,000	$1,170,000	$12,210,000
			High	$16,280,000	$1,702,000	$17,982,000
	0.05<DF≤1	1	Low	$1,320,000	$121,000	$1,441,000
			High	$2,410,000	$231,000	$2,641,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**11**	**Low**	**$12,360,000**	**$1,291,000**	**$13,651,000**
			High	**$18,690,000**	**$1,933,000**	**$20,623,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290106 Sac	DF≤0.05	10	Low	$11,180,000	$1,170,000	$12,350,000
			High	$17,260,000	$1,774,000	$19,034,000
	0.05<DF≤1	2	Low	$2,640,000	$242,000	$2,882,000
			High	$4,820,000	$462,000	$5,282,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**12**	**Low**	**$13,820,000**	**$1,412,000**	**$15,232,000**
			High	**$22,080,000**	**$2,236,000**	**$24,316,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290107 Pomme de Terre	DF≤0.05	11	Low	$12,340,000	$1,287,000	$13,627,000
			High	$19,280,000	$1,973,000	$21,253,000
	0.05<DF≤1	2	Low	$2,830,000	$253,000	$3,083,000
			High	$5,450,000	$510,000	$5,960,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**13**	**Low**	**$15,170,000**	**$1,540,000**	**$16,710,000**
			High	**$24,730,000**	**$2,483,000**	**$27,213,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290108 South Grand	DF≤0.05	36	Low	$40,010,000	$4,212,000	$44,222,000
			High	$60,470,000	$6,264,000	$66,734,000
	0.05<DF≤1	2	Low	$2,640,000	$242,000	$2,882,000
			High	$4,820,000	$462,000	$5,282,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**38**	**Low**	**$42,650,000**	**$4,454,000**	**$47,104,000**
			High	**$65,290,000**	**$6,726,000**	**$72,016,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290109 Lake of the Ozarks	DF≤0.05	319	Low	$353,380,000	$37,323,000	$390,703,000
			High	$527,760,000	$54,913,000	$582,673,000
	0.05<DF≤1	14	Low	$20,990,000	$1,868,000	$22,858,000
			High	$40,590,000	$3,755,000	$44,345,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**333**	**Low**	**$374,370,000**	**$39,191,000**	**$413,561,000**
			High	**$568,350,000**	**$58,668,000**	**$627,018,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290110 Niangua	DF≤0.05	82	Low	$90,570,000	$9,594,000	$100,164,000
			High	$133,790,000	$13,978,000	$147,768,000
	0.05<DF≤1	6	Low	$8,300,000	$748,000	$9,048,000
			High	$15,720,000	$1,482,000	$17,202,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**88**	**Low**	**$98,870,000**	**$10,342,000**	**$109,212,000**
			High	**$149,510,000**	**$15,460,000**	**$164,970,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10290111 Lower Osage	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,090,000**	**$117,000**	**$1,207,000**
			High	**$1,530,000**	**$163,000**	**$1,693,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10300101 Lower Missouri – Crooked	DF≤0.05	6	Low	$6,680,000	$702,000	$7,382,000
			High	$10,160,000	$1,050,000	$11,210,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**6**	**Low**	**$6,680,000**	**$702,000**	**$7,382,000**
			High	**$10,160,000**	**$1,050,000**	**$11,210,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10300102 Lower Missouri – Moreau	DF≤0.05	7	Low	$7,700,000	$819,000	$8,519,000
			High	$11,200,000	$1,177,000	$12,377,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**7**	**Low**	**$7,700,000**	**$819,000**	**$8,519,000**
			High	**$11,200,000**	**$1,177,000**	**$12,377,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
10300200 Lower Missouri	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,090,000**	**$117,000**	**$1,207,000**
			High	**$1,530,000**	**$163,000**	**$1,693,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010001 Beaver Reservoir	DF≤0.05	117	Low	$130,820,000	$13,689,000	$144,509,000
			High	$186,800,000	$15,023,000	$201,823,000
	0.05<DF≤1	7	Low	$10,250,000	$914,000	$11,164,000
			High	$16,740,000	$1,093,000	$17,833,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**124**	**Low**	**$141,070,000**	**$14,603,000**	**$155,673,000**
			High	**$203,540,000**	**$16,116,000**	**$219,656,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010002 James	DF≤0.05	40	Low	$44,860,000	$4,680,000	$49,540,000
			High	$64,520,000	$5,138,000	$69,658,000
	0.05<DF≤1	3	Low	$4,950,000	$430,000	$5,380,000
			High	$8,260,000	$522,000	$8,782,000
	1<DF≤20	3	Low	$25,740,000	$1,834,000	$27,574,000
			High	$35,480,000	$2,048,000	$37,528,000
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**46**	**Low**	**$75,550,000**	**$6,944,000**	**$82,494,000**
			High	**$108,260,000**	**$7,708,000**	**$115,968,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010003 Bull Shoals Lake	DF≤0.05	33	Low	$36,880,000	$3,861,000	$40,741,000
			High	$53,740,000	$4,727,000	$58,467,000
	0.05<DF≤1	4	Low	$7,870,000	$676,000	$8,546,000
			High	$12,210,000	$791,000	$13,001,000
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**37**	**Low**	**$44,750,000**	**$4,537,000**	**$49,287,000**
			High	**$65,950,000**	**$5,518,000**	**$71,468,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010006 North Fork White	DF≤0.05	1	Low	$1,160,000	$117,000	$1,277,000
			High	$2,020,000	$199,000	$2,219,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,160,000**	**$117,000**	**$1,277,000**
			High	**$2,020,000**	**$199,000**	**$2,219,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11010010 Spring	DF≤0.05	1	Low	$1,090,000	$117,000	$1,207,000
			High	$1,530,000	$163,000	$1,693,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**1**	**Low**	**$1,090,000**	**$117,000**	**$1,207,000**
			High	**$1,530,000**	**$163,000**	**$1,693,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11070207 Spring	DF≤0.05	11	Low	$12,200,000	$1,287,000	$13,487,000
			High	$18,300,000	$1,901,000	$20,201,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**11**	**Low**	**$12,200,000**	**$1,287,000**	**$13,487,000**
			High	**$18,300,000**	**$1,901,000**	**$20,201,000**

HUC8	Design Flow (DF) in MGD	Number of Facilities		Capital Costs	Annual O&M	Total
11070208 Elk	DF≤0.05	3	Low	$3,340,000	$351,000	$3,691,000
			High	$5,080,000	$525,000	$5,605,000
	0.05<DF≤1	0	Low	$0	$0	$0
			High	$0	$0	$0
	1<DF≤20	0	Low	$0	$0	$0
			High	$0	$0	$0
	DF>20	0	Low	$0	$0	$0
			High	$0	$0	$0
	Totals	**3**	**Low**	**$3,340,000**	**$351,000**	**$3,691,000**
			High	**$5,080,000**	**$525,000**	**$5,605,000**

Appendix D

Water quality monitoring costs by watershed for implementation of numeric nutrient criteria using 8-digit hydrologic unit codes (HUC). Watersheds not represented in the below tables do not have facilities discharging to lake watersheds affected by the proposed rule.

Monitoring Expenses by HUC – All Lakes

Assumptions:

- A staff of two will not be able to accomplish this workload in one year. Assignation of more staff will result in the same expense as if two carry out sample collection over a number of years.

- Round trip distance from the DNR lab in Jefferson City was estimated by selecting a town centrally located in each HUC 8, running a MapQuest quarry, and doubling the mileage presented.

- Time spent visiting each lake included travel time to and from the HUC 8 at an average speed of 50 mph, and an additional 3 hours for location of the lake and sampling activity. Each trip is devoted to sampling a single lake. It is probable that most actual sampling trips will involve work on more than one lake at a time.

- Staffing expenses are based on a salary of $23.15 per hour plus fringe and indirect expenses that total to $42.90 per hour.

- Vehicle expenses are set at $0.50 per mile.

- Overnight expenses are included if the round trip distance from the Lab is greater than 250 miles. It includes lodging, meals, and incidental expenses for a total of $188.33 per staff member per night.

- Sample analysis is based on the following costs per sample:
  - Total Nitrogen - $22
  - Total Phosphorus - $22
  - Chlorophyll-a - $11.75
  - Non-volatile Suspended Solids - $7.10
  - Total - $62.85

HUC 8		
All	Number of Lakes	1,034
	Round Trip Distance from Lab (mi)	
	Hours to visit each lake	
	Staff Expense (2 Employees)	$722,281.56
	Vehicle Expense	$132,905.00
	Overnight Expense	$227,5023.64
	Sample Analysis	$64,986.90
	Total Expense for single visit of all lakes	$1,147,676.11
	Single Year Sampling (4 visits)	$4,590,704.44
	Three Year Sampling (12 visits)	$13,772,113.32

HUC 8		
07110001 Bear-Wyaconda	Number of Lakes	14
	Round Trip Distance from Lab (mi)	324
	Hours to visit each lake	9.5
	Staff Expense (2 Employees)	$11,387.38
	Vehicle Expense	$2,268.00
	Overnight Expense	$5,273.24
	Sample Analysis	$879.90
	Total Expense for single visit of all lakes	$19,908.52
	Single Year Sampling (4 visits)	$68,687.60
	Three Year Sampling (12 visits)	$237,702.24

HUC 8		
07110002 North Fabius	Number of Lakes	22
	Round Trip Distance from Lab (mi)	310
	Hours to visit each lake	9.2
	Staff Expense (2 Employees)	$17,365.92
	Vehicle Expense	$3,410.00
	Overnight Expense	$8,268.52
	Sample Analysis	$1,382.70
	Total Expense for single visit of all lakes	$30,445.14
	Single Year Sampling (4 visits)	$121,780.56
	Three Year Sampling (12 visits)	$365,341.68

HUC 8		
07110003 South Fabius	Number of Lakes	7
	Round Trip Distance from Lab (mi)	274
	Hours to visit each lake	8.5
	Staff Expense (2 Employees)	$5,093.09
	Vehicle Expense	$959.00
	Overnight Expense	$2,636.62
	Sample Analysis	$439.95
	Total Expense for single visit of all lakes	$9,128.66
	Single Year Sampling (4 visits)	$36,514.64
	Three Year Sampling (12 visits)	$109,543.92

HUC 8		
07110004 The Sny	Number of Lakes	11
	Round Trip Distance from Lab (mi)	212
	Hours to visit each lake	7.2
	Staff Expense (2 Employees)	$6,833.11
	Vehicle Expense	$1, 166.00
	Overnight Expense	$0.00
	Sample Analysis	$691.35
	Total Expense for single visit of all lakes	$8,690.46
	Single Year Sampling (4 visits)	$34,761.84
	Three Year Sampling (12 visits)	$104,285.52

HUC 8		
07110005 North Fork Salt	Number of Lakes	17
	Round Trip Distance from Lab (mi)	204
	Hours to visit each lake	7.1
	Staff Expense (2 Employees)	$10,326.89
	Vehicle Expense	$1,734.00
	Overnight Expense	$0.00
	Sample Analysis	$1,068.45
	Total Expense for single visit of all lakes	$13,129.34
	Single Year Sampling (4 visits)	$52,517.36
	Three Year Sampling (12 visits)	$157,522.08

HUC 8		
07110006 South Fork Salt	Number of Lakes	41
	Round Trip Distance from Lab (mi)	150
	Hours to visit each lake	6.0
	Staff Expense (2 Employees)	$21,106.80
	Vehicle Expense	$3,075.00
	Overnight Expense	$0.00
	Sample Analysis	$2,576.85
	Total Expense for single visit of all lakes	$26,758.65
	Single Year Sampling (4 visits)	$107,034.60
	Three Year Sampling (12 visits)	$321,103.80

HUC 8		
07110007 Salt	Number of Lakes	13
	Round Trip Distance from Lab (mi)	174
	Hours to visit each lake	6.5
	Staff Expense (2 Employees)	$7,227.79
	Vehicle Expense	$1,131.00
	Overnight Expense	$0.00
	Sample Analysis	$817.05
	Total Expense for single visit of all lakes	$9,175.84
	Single Year Sampling (4 visits)	$36,703.36
	Three Year Sampling (12 visits)	$110,110.08

HUC 8		
07110008 Cuivre	Number of Lakes	30
	Round Trip Distance from Lab (mi)	150
	Hours to visit each lake	6.0
	Staff Expense (2 Employees)	$15,444.00
	Vehicle Expense	$$2,250.00
	Overnight Expense	$0.00
	Sample Analysis	$1,885.50
	Total Expense for single visit of all lakes	$19,579.50
	Single Year Sampling (4 visits)	$78,318.00
	Three Year Sampling (12 visits)	$234,954.00

HUC 8		
07110009 Peruque – Piasa	Number of Lakes	12
	Round Trip Distance from Lab (mi)	216
	Hours to visit each lake	7.3
	Staff Expense (2 Employees)	$7,536.37
	Vehicle Expense	$1,296.00
	Overnight Expense	$0.00
	Sample Analysis	$754.20
	Total Expense for single visit of all lakes	$9.586.87
	Single Year Sampling (4 visits)	$38.347.48
	Three Year Sampling (12 visits)	$115.042.44

HUC 8		
07140101 Cahokia – Joachim	Number of Lakes	26
	Round Trip Distance from Lab (mi)	270
	Hours to visit each lake	8.4
	Staff Expense (2 Employees)	$18,738.72
	Vehicle Expense	$3,510.00
	Overnight Expense	$9,793.16
	Sample Analysis	$1,634.10
	Total Expense for single visit of all lakes	$33,675.98
	Single Year Sampling (4 visits)	$134,703.92
	Three Year Sampling (12 visits)	$404,111.76

HUC 8		
07140102 Meramec	Number of Lakes	37
	Round Trip Distance from Lab (mi)	218
	Hours to visit each lake	8.4
	Staff Expense (2 Employees)	$23,365.06
	Vehicle Expense	$4,033.00
	Overnight Expense	$0.00
	Sample Analysis	$2,325.45
	Total Expense for single visit of all lakes	$29,723.51
	Single Year Sampling (4 visits)	$118,894.04
	Three Year Sampling (12 visits)	$356,682.12

HUC 8		
07140103 Bourbeuse	Number of Lakes	14
	Round Trip Distance from Lab (mi)	176
	Hours to visit each lake	6.5
	Staff Expense (2 Employees)	$7,831.82
	Vehicle Expense	$1,232.00
	Overnight Expense	$0.00
	Sample Analysis	$2,325.45
	Total Expense for single visit of all lakes	$29,723.51
	Single Year Sampling (4 visits)	$118,894.04
	Three Year Sampling (12 visits)	$356,682.12

HUC 8		
07140104 Big	Number of Lakes	47
	Round Trip Distance from Lab (mi)	266
	Hours to visit each lake	8.3
	Staff Expense (2 Employees)	$33,551.23
	Vehicle Expense	$6,251.00
	Overnight Expense	$17,703.02
	Sample Analysis	$2,953.95
	Total Expense for single visit of all lakes	$60,459.20
	Single Year Sampling (4 visits)	$241,836.80
	Three Year Sampling (12 visits)	$725,510.40

HUC 8		
07140105 Upper Mississippi – Cape Girardeau	Number of Lakes	27
	Round Trip Distance from Lab (mi)	412
	Hours to visit each lake	11.2
	Staff Expense (2 Employees)	$26,038.58
	Vehicle Expense	$5,562.00
	Overnight Expense	$10,169.82
	Sample Analysis	$1,696.95
	Total Expense for single visit of all lakes	$43,467.35
	Single Year Sampling (4 visits)	$173,869.40
	Three Year Sampling (12 visits)	$521,608.20

HUC 8		
07140107 Whitewater	Number of Lakes	14
	Round Trip Distance from Lab (mi)	394
	Hours to visit each lake	10.9
	Staff Expense (2 Employees)	$13,069.06
	Vehicle Expense	$2,758.00
	Overnight Expense	$5,273.24
	Sample Analysis	$879.90
	Total Expense for single visit of all lakes	$21,980.20
	Single Year Sampling (4 visits)	$87,920.80
	Three Year Sampling (12 visits)	$263,762.40

HUC 8		
08020202 Upper St Francis	Number of Lakes	32
	Round Trip Distance from Lab (mi)	332
	Hours to visit each lake	9.6
	Staff Expense (2 Employees)	$26,467.58
	Vehicle Expense	$5,312.00
	Overnight Expense	$12,053.12
	Sample Analysis	$2,011.20
	Total Expense for single visit of all lakes	$45,843.90
	Single Year Sampling (4 visits)	$183,375.60
	Three Year Sampling (12 visits)	$550,126.80

HUC 8		
08020203 Lower St Francis	Number of Lakes	2
	Round Trip Distance from Lab (mi)	464
	Hours to visit each lake	12.3
	Staff Expense (2 Employees)	$2,107.25
	Vehicle Expense	$464.00
	Overnight Expense	$753.32
	Sample Analysis	$125.70
	Total Expense for single visit of all lakes	$3,450.27
	Single Year Sampling (4 visits)	$13,801.08
	Three Year Sampling (12 visits)	$41,403.24

HUC 8		
08020204 Little River Ditches	Number of Lakes	1
	Round Trip Distance from Lab (mi)	486
	Hours to visit each lake	12.7
	Staff Expense (2 Employees)	$1,091.38
	Vehicle Expense	$243.00
	Overnight Expense	$376.66
	Sample Analysis	$62.85
	Total Expense for single visit of all lakes	$1,773.89
	Single Year Sampling (4 visits)	$7,095.56
	Three Year Sampling (12 visits)	$21,286.68

HUC 8		
10240010 Nodaway	Number of Lakes	3
	Round Trip Distance from Lab (mi)	498
	Hours to visit each lake	13.0
	Staff Expense (2 Employees)	$3,335.90
	Vehicle Expense	$747.00
	Overnight Expense	$1,129.98
	Sample Analysis	$188.55
	Total Expense for single visit of all lakes	$5,401.43
	Single Year Sampling (4 visits)	$21,605.72
	Three Year Sampling (12 visits)	$64,817.16

HUC 8		
10240011 Independence – Sugar	Number of Lakes	9
	Round Trip Distance from Lab (mi)	392
	Hours to visit each lake	10.8
	Staff Expense (2 Employees)	$8,370.65
	Vehicle Expense	$1,764.00
	Overnight Expense	$3,389.94
	Sample Analysis	$565.65
	Total Expense for single visit of all lakes	$14,090.24
	Single Year Sampling (4 visits)	$56,360.96
	Three Year Sampling (12 visits)	$169,082.88

HUC 8		
10240012 Platte	Number of Lakes	15
	Round Trip Distance from Lab (mi)	380
	Hours to visit each lake	10.6
	Staff Expense (2 Employees)	$13,642.20
	Vehicle Expense	$2,850.00
	Overnight Expense	$5,649.90
	Sample Analysis	$942.75
	Total Expense for single visit of all lakes	$23,084.85
	Single Year Sampling (4 visits)	$92,339.40
	Three Year Sampling (12 visits)	$277,018.20

HUC 8		
10240013 One Hundred and Two	Number of Lakes	3
	Round Trip Distance from Lab (mi)	484
	Hours to visit each lake	12.7
	Staff Expense (2 Employees)	$3,263.83
	Vehicle Expense	$726.00
	Overnight Expense	$1,129.98
	Sample Analysis	$188.55
	Total Expense for single visit of all lakes	$5,308.36
	Single Year Sampling (4 visits)	$21,233.44
	Three Year Sampling (12 visits)	$63,700.32

HUC 8		
10280101 Upper Grand	Number of Lakes	39
	Round Trip Distance from Lab (mi)	422
	Hours to visit each lake	11.4
	Staff Expense (2 Employees)	$38,280.53
	Vehicle Expense	$8,229.00
	Overnight Expense	$14,689.74
	Sample Analysis	$2,451.15
	Total Expense for single visit of all lakes	$63,650.42
	Single Year Sampling (4 visits)	$254,601.68
	Three Year Sampling (12 visits)	$763,805.04

HUC 8		
10280102 Thompson	Number of Lakes	19
	Round Trip Distance from Lab (mi)	374
	Hours to visit each lake	10.5
	Staff Expense (2 Employees)	$17,084.50
	Vehicle Expense	$3,553.00
	Overnight Expense	$7,156.54
	Sample Analysis	$1,194.15
	Total Expense for single visit of all lakes	$28,988.19
	Single Year Sampling (4 visits)	$115,952.76
	Three Year Sampling (12 visits)	$347,858.28

HUC 8		
10280103 Lower Grand	Number of Lakes	35
	Round Trip Distance from Lab (mi)	312
	Hours to visit each lake	9.2
	Staff Expense (2 Employees)	$27,747.72
	Vehicle Expense	$5,460.00
	Overnight Expense	$13,183.30
	Sample Analysis	$2,199.75
	Total Expense for single visit of all lakes	$48,590.57
	Single Year Sampling (4 visits)	$194,362.28
	Three Year Sampling (12 visits)	$583,086.84

HUC 8		
10280201 Upper Chariton	Number of Lakes	5
	Round Trip Distance from Lab (mi)	340
	Hours to visit each lake	9.8
	Staff Expense (2 Employees)	$4,204.20
	Vehicle Expense	$850.00
	Overnight Expense	$1,833.30
	Sample Analysis	$314.25
	Total Expense for single visit of all lakes	$7,251.75
	Single Year Sampling (4 visits)	$29,007.00
	Three Year Sampling (12 visits)	$87,021.00

HUC 8		
10280202 Lower Chariton	Number of Lakes	13
	Round Trip Distance from Lab (mi)	242
	Hours to visit each lake	7.8
	Staff Expense (2 Employees)	$8,744.74
	Vehicle Expense	$1,573.00
	Overnight Expense	$0.00
	Sample Analysis	$817.05
	Total Expense for single visit of all lakes	$11,134.79
	Single Year Sampling (4 visits)	$44,539.16
	Three Year Sampling (12 visits)	$133,617.48

HUC 8		
10280203 Little Chariton	Number of Lakes	18
	Round Trip Distance from Lab (mi)	178
	Hours to visit each lake	6.6
	Staff Expense (2 Employees)	$10,131.26
	Vehicle Expense	$1,602.00
	Overnight Expense	$0.00
	Sample Analysis	$1,131.30
	Total Expense for single visit of all lakes	$12,864.56
	Single Year Sampling (4 visits)	$51,458.24
	Three Year Sampling (12 visits)	$154,374.72

HUC 8		
10290102 Lower Marais des Cygnes	Number of Lakes	11
	Round Trip Distance from Lab (mi)	278
	Hours to visit each lake	8.6
	Staff Expense (2 Employees)	$8,078.93
	Vehicle Expense	$1,529.00
	Overnight Expense	$4,143.26
	Sample Analysis	$691.35
	Total Expense for single visit of all lakes	$14,442.54
	Single Year Sampling (4 visits)	$57,770.16
	Three Year Sampling (12 visits)	$173,310.48

HUC 8		
10290103 Little Osage	Number of Lakes	4
	Round Trip Distance from Lab (mi)	348
	Hours to visit each lake	10.0
	Staff Expense (2 Employees)	$3,418.27
	Vehicle Expense	$696.00
	Overnight Expense	$1,506.64
	Sample Analysis	$251.40
	Total Expense for single visit of all lakes	$5,872.31
	Single Year Sampling (4 visits)	$23,489.24
	Three Year Sampling (12 visits)	$70,467.72

HUC 8		
10290104 Marmaton	Number of Lakes	4
	Round Trip Distance from Lab (mi)	342
	Hours to visit each lake	9.8
	Staff Expense (2 Employees)	$3,377.09
	Vehicle Expense	$684.00
	Overnight Expense	$753.32
	Sample Analysis	$251.40
	Total Expense for single visit of all lakes	$5,065.81
	Single Year Sampling (4 visits)	$20,263.24
	Three Year Sampling (12 visits)	$60,789.72

HUC 8		
10290105 Harry S Truman Reservoir	Number of Lakes	20
	Round Trip Distance from Lab (mi)	268
	Hours to visit each lake	8.4
	Staff Expense (2 Employees)	$14,345.76
	Vehicle Expense	$2,680.00
	Overnight Expense	$7,533.20
	Sample Analysis	$1,257.00
	Total Expense for single visit of all lakes	$25,815.96
	Single Year Sampling (4 visits)	$103,263.84
	Three Year Sampling (12 visits)	$309,791.52

HUC 8		
10290106 Sac	Number of Lakes	12
	Round Trip Distance from Lab (mi)	280
	Hours to visit each lake	8.6
	Staff Expense (2 Employees)	$8,854.56
	Vehicle Expense	$1,680.00
	Overnight Expense	$4,519.92
	Sample Analysis	$754.20
	Total Expense for single visit of all lakes	$15,808.68
	Single Year Sampling (4 visits)	$63,234.72
	Three Year Sampling (12 visits)	$189,704.16

HUC 8		
10290107 Pomme de Terre	Number of Lakes	3
	Round Trip Distance from Lab (mi)	232
	Hours to visit each lake	7.6
	Staff Expense (2 Employees)	$1,966.54
	Vehicle Expense	$348.00
	Overnight Expense	$0.00
	Sample Analysis	$188.55
	Total Expense for single visit of all lakes	$2,503.09
	Single Year Sampling (4 visits)	$10,012.36
	Three Year Sampling (12 visits)	$30,037.08

HUC 8		
10290108 South Grand	Number of Lakes	103
	Round Trip Distance from Lab (mi)	252
	Hours to visit each lake	8.0
	Staff Expense (2 Employees)	$71,052.0
	Vehicle Expense	$12,978.00
	Overnight Expense	$38,795.98
	Sample Analysis	$6,473.55
	Total Expense for single visit of all lakes	$129,300.23
	Single Year Sampling (4 visits)	$517,200.92
	Three Year Sampling (12 visits)	$1,551,602.76

HUC 8		
10290109 Lake of the Ozarks	Number of Lakes	12
	Round Trip Distance from Lab (mi)	116
	Hours to visit each lake	5.3
	Staff Expense (2 Employees)	$5,477.47
	Vehicle Expense	$696.00
	Overnight Expense	$0.00
	Sample Analysis	$754.20
	Total Expense for single visit of all lakes	$6,927.67
	Single Year Sampling (4 visits)	$27,710.68
	Three Year Sampling (12 visits)	$83,132.04

HUC 8		
10290110 Niangua	Number of Lakes	2
	Round Trip Distance from Lab (mi)	190
	Hours to visit each lake	6.8
	Staff Expense (2 Employees)	$1,166.88
	Vehicle Expense	$190.00
	Overnight Expense	$0.00
	Sample Analysis	$125.70
	Total Expense for single visit of all lakes	$1,482.58
	Single Year Sampling (4 visits)	$5,930.32
	Three Year Sampling (12 visits)	$17,790.96

HUC 8		
10290111 Lower Osage	Number of Lakes	7
	Round Trip Distance from Lab (mi)	70
	Hours to visit each lake	4.4
	Staff Expense (2 Employees)	$2,642.64
	Vehicle Expense	$245.00
	Overnight Expense	$0.00
	Sample Analysis	$439.95
	Total Expense for single visit of all lakes	$3,327.59
	Single Year Sampling (4 visits)	$13,310.36
	Three Year Sampling (12 visits)	$39,931.08

HUC 8		
10290201 Upper Gasconade	Number of Lakes	9
	Round Trip Distance from Lab (mi)	240
	Hours to visit each lake	7.8
	Staff Expense (2 Employees)	$6,023.16
	Vehicle Expense	$1,080.00
	Overnight Expense	$0.00
	Sample Analysis	$565.65
	Total Expense for single visit of all lakes	$5,435.08
	Single Year Sampling (4 visits)	$21,740.32
	Three Year Sampling (12 visits)	$65,220.96

HUC 8		
10290202 Big Piney	Number of Lakes	1
	Round Trip Distance from Lab (mi)	226
	Hours to visit each lake	7.5
	Staff Expense (2 Employees)	$645.22
	Vehicle Expense	$113.00
	Overnight Expense	$0.00
	Sample Analysis	$62.85
	Total Expense for single visit of all lakes	$821.07
	Single Year Sampling (4 visits)	$3,284.25
	Three Year Sampling (12 visits)	$9,852.84

HUC 8		
10290203 Lower Gasconade	Number of Lakes	9
	Round Trip Distance from Lab (mi)	128
	Hours to visit each lake	5.6
	Staff Expense (2 Employees)	$4,293.43
	Vehicle Expense	$576
	Overnight Expense	$0.00
	Sample Analysis	$565.65
	Total Expense for single visit of all lakes	$7,668.81
	Single Year Sampling (4 visits)	$30,675.24
	Three Year Sampling (12 visits)	$92,025.72

HUC 8		
10300101 Lower Missouri – Crooked	Number of Lakes	55
	Round Trip Distance from Lab (mi)	266
	Hours to visit each lake	8.3
	Staff Expense (2 Employees)	$39,262.08
	Vehicle Expense	$7,315.00
	Overnight Expense	$20,716.30
	Sample Analysis	$3,456.75
	Total Expense for single visit of all lakes	$70,750.13
	Single Year Sampling (4 visits)	$283,000.52
	Three Year Sampling (12 visits)	$849,001.56

HUC 8		
10300102 Lower Missouri – Moreau	Number of Lakes	82
	Round Trip Distance from Lab (mi)	96
	Hours to visit each lake	4.9
	Staff Expense (2 Employees)	$34,615.15
	Vehicle Expense	$3,936.00
	Overnight Expense	$0.00
	Sample Analysis	$5,153.70
	Total Expense for single visit of all lakes	$43,704.85
	Single Year Sampling (4 visits)	$174,567.92
	Three Year Sampling (12 visits)	$524,458.20

HUC 8		
10300103 Lamine	Number of Lakes	14
	Round Trip Distance from Lab (mi)	118
	Hours to visit each lake	5.4
	Staff Expense (2 Employees)	$6,438.43
	Vehicle Expense	$826.00
	Overnight Expense	$0.00
	Sample Analysis	$879.90
	Total Expense for single visit of all lakes	$8,144.33
	Single Year Sampling (4 visits)	$32,577.32
	Three Year Sampling (12 visits)	$97,731.96

HUC 8		
10300104 Blackwater	Number of Lakes	38
	Round Trip Distance from Lab (mi)	176
	Hours to visit each lake	6.5
	Staff Expense (2 Employees)	$21,257,.81
	Vehicle Expense	$3,344.00
	Overnight Expense	$0.00
	Sample Analysis	$2,388.30
	Total Expense for single visit of all lakes	$26,990.11
	Single Year Sampling (4 visits)	$107,960.44
	Three Year Sampling (12 visits)	$323,881.32

HUC 8		
10300200 Lower Missouri	Number of Lakes	47
	Round Trip Distance from Lab (mi)	228
	Hours to visit each lake	7.6
	Staff Expense (2 Employees)	$30,486.46
	Vehicle Expense	$5,358.00
	Overnight Expense	$0.00
	Sample Analysis	$2,953.95
	Total Expense for single visit of all lakes	$38,798.41
	Single Year Sampling (4 visits)	$155,193.64
	Three Year Sampling (12 visits)	$465,580.92

HUC 8		
11010001 Beaver Reservoir	Number of Lakes	1
	Round Trip Distance from Lab (mi)	380
	Hours to visit each lake	10.6
	Staff Expense (2 Employees)	$909.48
	Vehicle Expense	$190.00
	Overnight Expense	$376.66
	Sample Analysis	$62.85
	Total Expense for single visit of all lakes	$1,538.99
	Single Year Sampling (4 visits)	$6,155.96
	Three Year Sampling (12 visits)	$18,467.88

HUC 8		
11010002 James	Number of Lakes	1
	Round Trip Distance from Lab (mi)	338
	Hours to visit each lake	9.8
	Staff Expense (2 Employees)	$837.41
	Vehicle Expense	$169.00
	Overnight Expense	$376.66
	Sample Analysis	$62.85
	Total Expense for single visit of all lakes	$1,445.92
	Single Year Sampling (4 visits)	$5,783.68
	Three Year Sampling (12 visits)	$17.351.04

HUC 8		
11010003 Bull Shoals Lake	Number of Lakes	3
	Round Trip Distance from Lab (mi)	362
	Hours to visit each lake	10.2
	Staff Expense (2 Employees)	$2,635.78
	Vehicle Expense	$543.00
	Overnight Expense	$1,129.98
	Sample Analysis	$188.55
	Total Expense for single visit of all lakes	$4,497.31
	Single Year Sampling (4 visits)	$17,989.24
	Three Year Sampling (12 visits)	$53,967.72

HUC 8		
11010006 North Fork White	Number of Lakes	1
	Round Trip Distance from Lab (mi)	352
	Hours to visit each lake	10.0
	Staff Expense (2 Employees)	$861.43
	Vehicle Expense	$176.00
	Overnight Expense	$376.66
	Sample Analysis	$62.85
	Total Expense for single visit of all lakes	$1,476.94
	Single Year Sampling (4 visits)	$5,907.76
	Three Year Sampling (12 visits)	$17,723.28

HUC 8		
11010007 Upper Black	Number of Lakes	22
	Round Trip Distance from Lab (mi)	416
	Hours to visit each lake	11.3
	Staff Expense (2 Employees)	$21,367.63
	Vehicle Expense	$4,576.00
	Overnight Expense	$8,286.52
	Sample Analysis	$1,382.70
	Total Expense for single visit of all lakes	$35,612.85
	Single Year Sampling (4 visits)	$142,451.40
	Three Year Sampling (12 visits)	$427,354.20

HUC 8		
11010008 Current	Number of Lakes	8
	Round Trip Distance from Lab (mi)	338
	Hours to visit each lake	9.8
	Staff Expense (2 Employees)	$6,699.26
	Vehicle Expense	$1,352.00
	Overnight Expense	$3,013.28
	Sample Analysis	$502.80
	Total Expense for single visit of all lakes	$11,567.34
	Single Year Sampling (4 visits)	$46,269.36
	Three Year Sampling (12 visits)	$138,808.08

HUC 8		
11010009 Lower Black	Number of Lakes	2
	Round Trip Distance from Lab (mi)	410
	Hours to visit each lake	11.2
	Staff Expense (2 Employees)	$1,921.92
	Vehicle Expense	$410.00
	Overnight Expense	$753.32
	Sample Analysis	$125.70
	Total Expense for single visit of all lakes	$3,210.94
	Single Year Sampling (4 visits)	$12,843.76
	Three Year Sampling (12 visits)	$38,531.28

HUC 8		
11010010 Spring	Number of Lakes	8
	Round Trip Distance from Lab (mi)	350
	Hours to visit each lake	10.0
	Staff Expense (2 Employees)	$6,864.00
	Vehicle Expense	$1,400.00
	Overnight Expense	$3,013.28
	Sample Analysis	$502.80
	Total Expense for single visit of all lakes	$11,780.08
	Single Year Sampling (4 visits)	$47,120.32
	Three Year Sampling (12 visits)	$141,360.96

HUC 8		
11010011 Eleven Point	Number of Lakes	3
	Round Trip Distance from Lab (mi)	348
	Hours to visit each lake	10.0
	Staff Expense (2 Employees)	$2,563.70
	Vehicle Expense	$522.00
	Overnight Expense	$1,129.98
	Sample Analysis	$188.55
	Total Expense for single visit of all lakes	$4,404.23
	Single Year Sampling (4 visits)	$17,616.92
	Three Year Sampling (12 visits)	$52,850.76

HUC 8		
11070207 Spring	Number of Lakes	25
	Round Trip Distance from Lab (mi)	404
	Hours to visit each lake	11.1
	Staff Expense (2 Employees)	$23,766.60
	Vehicle Expense	$5,050.00
	Overnight Expense	$9,416.50
	Sample Analysis	$1,571.25
	Total Expense for single visit of all lakes	$39,804.35
	Single Year Sampling (4 visits)	$159,217.40
	Three Year Sampling (12 visits)	$477,652.20

HUC 8		
11070208 Elk	Number of Lakes	1
	Round Trip Distance from Lab (mi)	470
	Hours to visit each lake	12.4
	Staff Expense (2 Employees)	$1,063.92
	Vehicle Expense	$235.00
	Overnight Expense	$376.66
	Sample Analysis	$62.85
	Total Expense for single visit of all lakes	$1,738.43
	Single Year Sampling (4 visits)	$6,953.72
	Three Year Sampling (12 visits)	$20,861.16

Monitoring Expenses – Weight of Evidence Analysis

This section is a compilation of costs for weight of evidence studies on those lakes that are in Category 3 of the Integrated Report. It is expected that the list of lakes in this category will grow as more data become available. It is not known how Category 3 lakes will ultimately be distributed among the HUC 8s, so only those sections with lakes that are known to be in this status are included in the following tables.

Weight of evidence evaluations will include continuous studies of dissolved oxygen, as well as pH and turbidity. This will require a one-time purchase of 5 sondes that will be equipped with probes to read levels of dissolved oxygen, conductivity, pH and turbidity. The total cost of this equipment is estimated to be $89,588.00.

Assumptions:

- All of the assumptions applicable to the previous section are also effective for this section.
- Sample analysis will also include microcystin which is estimated to cost $150 for each sample.
- There are two additional trips to each of the lakes each year, for installation and removal of the sonde equipment. Calculation of one-year and three year costs include sampling analysis for four of the six trips each year.

HUC 8		
All	Number of Lakes	107
	Round Trip Distance from Lab (mi)	
	Hours to visit each lake	
	Staff Expense (2 Employees)	$76,990.06
	Vehicle Expense	$14,408.00
	Overnight Expense	$21,469.62
	Sample Analysis	$22,774.95
	Total Expense for single visit of all lakes	$135,6423.65
	Single Year Sampling (6 visits)	$768,305.95
	Three Year Sampling (18 visits)	$2,304,917.85

HUC 8		
07110002 North Fabius	Number of Lakes	4
	Round Trip Distance from Lab (mi)	310
	Hours to visit each lake	9.2
	Staff Expense (2 Employees)	$3,157.44
	Vehicle Expense	$620
	Overnight Expense	$1,506.64
	Sample Analysis	$851.40
	Total Expense for single visit of all lakes	$6,135.48
	Single Year Sampling (6 visits)	$35,110.08
	Three Year Sampling (18 visits)	$105,330.24

HUC 8		
07110003 South Fabius	Number of Lakes	1
	Round Trip Distance from Lab (mi)	274
	Hours to visit each lake	8.5
	Staff Expense (2 Employees)	$727.58
	Vehicle Expense	$137.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,454.09
	Single Year Sampling (6 visits)	$8,298.85
	Three Year Sampling (18 visits)	$24,896.55

HUC 8		
07110004 The Sny	Number of Lakes	4
	Round Trip Distance from Lab (mi)	212
	Hours to visit each lake	7.2
	Staff Expense (2 Employees)	$2,484.77
	Vehicle Expense	$424.00
	Overnight Expense	$0.00
	Sample Analysis	$851.40
	Total Expense for single visit of all lakes	$3,760.17
	Single Year Sampling (6 visits)	$20,858.22
	Three Year Sampling (18 visits)	$62,574.66

HUC 8		
07110005 North Fork Salt	Number of Lakes	5
	Round Trip Distance from Lab (mi)	204
	Hours to visit each lake	7.1
	Staff Expense (2 Employees)	$3,037.32
	Vehicle Expense	$510.00
	Overnight Expense	$0.00
	Sample Analysis	$1,064.25
	Total Expense for single visit of all lakes	$4,644.57
	Single Year Sampling (6 visits)	$25,540.92
	Three Year Sampling (18 visits)	$76,622.76

HUC 8		
07110006 South Fork Salt	Number of Lakes	1
	Round Trip Distance from Lab (mi)	150
	Hours to visit each lake	6.0
	Staff Expense (2 Employees)	$514.80
	Vehicle Expense	$75.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$802.65
	Single Year Sampling (6 visits)	$4,390.20
	Three Year Sampling (18 visits)	$13,170.60

HUC 8		
07110007 Salt	Number of Lakes	5
	Round Trip Distance from Lab (mi)	174
	Hours to visit each lake	6.5
	Staff Expense (2 Employees)	$2,779.92
	Vehicle Expense	$435.00
	Overnight Expense	$0.00
	Sample Analysis	$1,064.25
	Total Expense for single visit of all lakes	$4,279.17
	Single Year Sampling (6 visits)	$23,546.52
	Three Year Sampling (18 visits)	$70,639.56

HUC 8		
07110008 Cuivre	Number of Lakes	1
	Round Trip Distance from Lab (mi)	150
	Hours to visit each lake	6.0
	Staff Expense (2 Employees)	$514.80
	Vehicle Expense	$75.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$802.65
	Single Year Sampling (6 visits)	$4,390.20
	Three Year Sampling (18 visits)	$13,170.60

HUC 8		
07110009 Peruque – Piasa	Number of Lakes	1
	Round Trip Distance from Lab (mi)	216
	Hours to visit each lake	7.3
	Staff Expense (2 Employees)	$826.06
	Vehicle Expense	$108.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$948.91
	Single Year Sampling (6 visits)	$5,627.75
	Three Year Sampling (18 visits)	$15,803.25

HUC 8		
07140101 Cahokia – Joachim	Number of Lakes	1
	Round Trip Distance from Lab (mi)	270
	Hours to visit each lake	8.4
	Staff Expense (2 Employees)	$720.72
	Vehicle Expense	$135.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,445.23
	Single Year Sampling (6 visits)	$8,245.68
	Three Year Sampling (18 visits)	$24,737.04

HUC 8		
07140102 Meramec	Number of Lakes	1
	Round Trip Distance from Lab (mi)	218
	Hours to visit each lake	7.4
	Staff Expense (2 Employees)	$631.49
	Vehicle Expense	$109.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$953.34
	Single Year Sampling (6 visits)	$5,294.34
	Three Year Sampling (18 visits)	$15,883.02

HUC 8		
07140103 Bourbeuse	Number of Lakes	2
	Round Trip Distance from Lab (mi)	176
	Hours to visit each lake	6.5
	Staff Expense (2 Employees)	$1,118.83
	Vehicle Expense	$176.00
	Overnight Expense	$0.00
	Sample Analysis	$425.70
	Total Expense for single visit of all lakes	$1,720.53
	Single Year Sampling (6 visits)	$9,471.78
	Three Year Sampling (18 visits)	$28,415.34

HUC 8		
07140104 Big	Number of Lakes	1
	Round Trip Distance from Lab (mi)	266
	Hours to visit each lake	8.3
	Staff Expense (2 Employees)	$713.86
	Vehicle Expense	$133.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,436.37
	Single Year Sampling (6 visits)	$8,192.51
	Three Year Sampling (18 visits)	$24,577.53

HUC 8		
07140105 Upper Mississippi - Cape Girardeau	Number of Lakes	2
	Round Trip Distance from Lab (mi)	412
	Hours to visit each lake	11.2
	Staff Expense (2 Employees)	$1,928.78
	Vehicle Expense	$412.00
	Overnight Expense	$753.32
	Sample Analysis	$425.70
	Total Expense for single visit of all lakes	$3,519.80
	Single Year Sampling (6 visits)	$20,267.41
	Three Year Sampling (18 visits)	$60,802.23

HUC 8		
07140107 Whitewater	Number of Lakes	1
	Round Trip Distance from Lab (mi)	394
	Hours to visit each lake	10.9
	Staff Expense (2 Employees)	$933.50
	Vehicle Expense	$197.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,720.01
	Single Year Sampling (6 visits)	$9,894.37
	Three Year Sampling (18 visits)	$29,603.34

HUC 8		
08020202 Upper St Francis	Number of Lakes	2
	Round Trip Distance from Lab (mi)	332
	Hours to visit each lake	9.6
	Staff Expense (2 Employees)	$1,654.22
	Vehicle Expense	$332.00
	Overnight Expense	$753.32
	Sample Analysis	$425.70
	Total Expense for single visit of all lakes	$3,165.24
	Single Year Sampling (6 visits)	$18,140.05
	Three Year Sampling (18 visits)	$54,420.15

HUC 8		
08020204 Little River Ditches	Number of Lakes	1
	Round Trip Distance from Lab (mi)	486
	Hours to visit each lake	12.7
	Staff Expense (2 Employees)	$1,091.38
	Vehicle Expense	$243.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,923.89
	Single Year Sampling (6 visits)	$11,173.63
	Three Year Sampling (18 visits)	$33,352.89

HUC 8		
10240010 Nodaway	Number of Lakes	1
	Round Trip Distance from Lab (mi)	498
	Hours to visit each lake	13.0
	Staff Expense (2 Employees)	$1,111.97
	Vehicle Expense	$249.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,950.48
	Single Year Sampling (6 visits)	$11,277.18
	Three Year Sampling (18 visits)	$33,831.54

HUC 8		
10240011 Independence - Sugar	Number of Lakes	1
	Round Trip Distance from Lab (mi)	392
	Hours to visit each lake	10.8
	Staff Expense (2 Employees)	$930.07
	Vehicle Expense	$196.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,715.58
	Single Year Sampling (6 visits)	$9,867.78
	Three Year Sampling (18 visits)	$29,603.34

HUC 8		
10240012 Platte	Number of Lakes	1
	Round Trip Distance from Lab (mi)	380
	Hours to visit each lake	10.6
	Staff Expense (2 Employees)	$909.48
	Vehicle Expense	$190.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,688.99
	Single Year Sampling (6 visits)	$9,708.24
	Three Year Sampling (18 visits)	$29,124.72

HUC 8		
10240013 One Hundred and Two	Number of Lakes	2
	Round Trip Distance from Lab (mi)	484
	Hours to visit each lake	12.7
	Staff Expense (2 Employees)	$2,175.89
	Vehicle Expense	$484.00
	Overnight Expense	$753.32
	Sample Analysis	$425.70
	Total Expense for single visit of all lakes	$3,838.91
	Single Year Sampling (6 visits)	$22,182.06
	Three Year Sampling (18 visits)	$66,546.18

HUC 8		
10280101 Upper Grand	Number of Lakes	12
	Round Trip Distance from Lab (mi)	422
	Hours to visit each lake	11.4
	Staff Expense (2 Employees)	$11,778.62
	Vehicle Expense	$2,532.00
	Overnight Expense	$4,519.92
	Sample Analysis	$2,554.20
	Total Expense for single visit of all lakes	$21,384.74
	Single Year Sampling (6 visits)	$123,200.05
	Three Year Sampling (18 visits)	$369,600.15

HUC 8		
10280103 Lower Grand	Number of Lakes	5
	Round Trip Distance from Lab (mi)	312
	Hours to visit each lake	9.2
	Staff Expense (2 Employees)	$3,963.96
	Vehicle Expense	$780.00
	Overnight Expense	$1,883.30
	Sample Analysis	$1,064.25
	Total Expense for single visit of all lakes	$7,691.51
	Single Year Sampling (6 visits)	$44,020.56
	Three Year Sampling (18 visits)	$132,061.68

HUC 8		
10280201 Upper Chariton	Number of Lakes	3
	Round Trip Distance from Lab (mi)	340
	Hours to visit each lake	9.8
	Staff Expense (2 Employees)	$2,522.52
	Vehicle Expense	$510.00
	Overnight Expense	$1,129.98
	Sample Analysis	$638.55
	Total Expense for single visit of all lakes	$4,801.05
	Single Year Sampling (6 visits)	$27,529.20
	Three Year Sampling (18 visits)	$82,587.60

HUC 8		
10280202 Lower Chariton	Number of Lakes	3
	Round Trip Distance from Lab (mi)	242
	Hours to visit each lake	7.8
	Staff Expense (2 Employees)	$2,018.02
	Vehicle Expense	$363.00
	Overnight Expense	$0.00
	Sample Analysis	$638.55
	Total Expense for single visit of all lakes	$3,019.57
	Single Year Sampling (6 visits)	$16,840.31
	Three Year Sampling (18 visits)	$50,520.93

HUC 8		
10280203 Little Chariton	Number of Lakes	5
	Round Trip Distance from Lab (mi)	178
	Hours to visit each lake	6.6
	Staff Expense (2 Employees)	$2,814.24
	Vehicle Expense	$445.00
	Overnight Expense	$0.00
	Sample Analysis	$1,0664.25
	Total Expense for single visit of all lakes	$4,323.49
	Single Year Sampling (6 visits)	$23,812.44
	Three Year Sampling (18 visits)	$71,437.32

HUC 8		
10290102 Lower Marais des Cygnes	Number of Lakes	2
	Round Trip Distance from Lab (mi)	278
	Hours to visit each lake	8.6
	Staff Expense (2 Employees)	$1,468.90
	Vehicle Expense	$278.00
	Overnight Expense	$753.32
	Sample Analysis	$425.70
	Total Expense for single visit of all lakes	$2,925.92
	Single Year Sampling (6 visits)	$116,704.11
	Three Year Sampling (18 visits)	$50,112.33

HUC 8		
10290103 Little Osage	Number of Lakes	1
	Round Trip Distance from Lab (mi)	348
	Hours to visit each lake	10.0
	Staff Expense (2 Employees)	$854.57
	Vehicle Expense	$174.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,618.08
	Single Year Sampling (6 visits)	$9,282.78
	Three Year Sampling (18 visits)	$27,848.34

HUC 8		
10290105 Harry S Truman Reservoir	Number of Lakes	2
	Round Trip Distance from Lab (mi)	268
	Hours to visit each lake	8.4
	Staff Expense (2 Employees)	$1,434.58
	Vehicle Expense	$268.00
	Overnight Expense	$753.32
	Sample Analysis	$425.70
	Total Expense for single visit of all lakes	$2,881.60
	Single Year Sampling (6 visits)	$16,438.19
	Three Year Sampling (18 visits)	$49,314.57

HUC 8		
10290106 Sac	Number of Lakes	1
	Round Trip Distance from Lab (mi)	280
	Hours to visit each lake	8.6
	Staff Expense (2 Employees)	$737.88
	Vehicle Expense	$140.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,467.39
	Single Year Sampling (6 visits)	$8,378.64
	Three Year Sampling (18 visits)	$25,135.92

HUC 8		
10290107 Pomme de Terre	Number of Lakes	1
	Round Trip Distance from Lab (mi)	232
	Hours to visit each lake	7.6
	Staff Expense (2 Employees)	$655.51
	Vehicle Expense	$116.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$984.36
	Single Year Sampling (6 visits)	$5,480.46
	Three Year Sampling (18 visits)	$16,441.38

HUC 8		
10290108 South Grand	Number of Lakes	8
	Round Trip Distance from Lab (mi)	252
	Hours to visit each lake	8.0
	Staff Expense (2 Employees)	$5,518.66
	Vehicle Expense	$1,008.00
	Overnight Expense	$3,013.28
	Sample Analysis	$1,702.80
	Total Expense for single visit of all lakes	$11,242.74
	Single Year Sampling (6 visits)	$64,050.83
	Three Year Sampling (18 visits)	$192,152.49

HUC 8		
10290109 Lake of the Ozarks	Number of Lakes	1
	Round Trip Distance from Lab (mi)	116
	Hours to visit each lake	5.3
	Staff Expense (2 Employees)	$456.46
	Vehicle Expense	$58.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$727.31
	Single Year Sampling (6 visits)	$3,938.15
	Three Year Sampling (18 visits)	$11,814.45

HUC 8		
10290110 Niangua	Number of Lakes	1
	Round Trip Distance from Lab (mi)	190
	Hours to visit each lake	6.8
	Staff Expense (2 Employees)	$583.44
	Vehicle Expense	$95.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$891.29
	Single Year Sampling (6 visits)	$4,922.04
	Three Year Sampling (18 visits)	$14,766.12

HUC 8		
10290201 Upper Gasconade	Number of Lakes	1
	Round Trip Distance from Lab (mi)	240
	Hours to visit each lake	7.8
	Staff Expense (2 Employees)	$669.24
	Vehicle Expense	$120.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,002.09
	Single Year Sampling (6 visits)	$5,586.84
	Three Year Sampling (18 visits)	$16,760.52

HUC 8		
10300101 Lower Missouri – Crooked	Number of Lakes	2
	Round Trip Distance from Lab (mi)	266
	Hours to visit each lake	8.3
	Staff Expense (2 Employees)	$1,427.71
	Vehicle Expense	$266.00
	Overnight Expense	$753.32
	Sample Analysis	$425.70
	Total Expense for single visit of all lakes	$2,872.73
	Single Year Sampling (6 visits)	$16,384.98
	Three Year Sampling (18 visits)	$49,154.94

HUC 8		
10300102 Lower Missouri – Moreau	Number of Lakes	7
	Round Trip Distance from Lab (mi)	96
	Hours to visit each lake	4.9
	Staff Expense (2 Employees)	$2,954.95
	Vehicle Expense	$336.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$731.74
	Single Year Sampling (6 visits)	$3,964.74
	Three Year Sampling (18 visits)	$11,894.22

HUC 8		
10300103 Lamine	Number of Lakes	1
	Round Trip Distance from Lab (mi)	118
	Hours to visit each lake	5.4
	Staff Expense (2 Employees)	$459.89
	Vehicle Expense	$59.00
	Overnight Expense	$0.00
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$731.74
	Single Year Sampling (6 visits)	$3,964.74
	Three Year Sampling (18 visits)	$11,894.22

HUC 8		
10300104 Blackwater	Number of Lakes	3
	Round Trip Distance from Lab (mi)	176
	Hours to visit each lake	6.5
	Staff Expense (2 Employees)	$1,678.25
	Vehicle Expense	$264.00
	Overnight Expense	$0.00
	Sample Analysis	$638.55
	Total Expense for single visit of all lakes	$2,580.80
	Single Year Sampling (6 visits)	$14,207.70
	Three Year Sampling (18 visits)	$42,623.10

HUC 8		
10300200 Lower Missouri	Number of Lakes	7
	Round Trip Distance from Lab (mi)	228
	Hours to visit each lake	7.6
	Staff Expense (2 Employees)	$4,540.54
	Vehicle Expense	$798.00
	Overnight Expense	$0.00
	Sample Analysis	$1,489.95
	Total Expense for single visit of all lakes	$6,828.49
	Single Year Sampling (6 visits)	$37,991.03
	Three Year Sampling (18 visits)	$113,973.09

HUC 8		
11010003 Bull Shoals Lake	Number of Lakes	1
	Round Trip Distance from Lab (mi)	362
	Hours to visit each lake	10.2
	Staff Expense (2 Employees)	$878.59
	Vehicle Expense	$181.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,649.10
	Single Year Sampling (6 visits)	$9,468.90
	Three Year Sampling (18 visits)	$28,406.70

HUC 8		
11010007 Upper Black	Number of Lakes	1
	Round Trip Distance from Lab (mi)	416
	Hours to visit each lake	11.3
	Staff Expense (2 Employees)	$971.26
	Vehicle Expense	$208.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,768.77
	Single Year Sampling (6 visits)	$10,186.91
	Three Year Sampling (18 visits)	$30,560.73

HUC 8		
11010008 Current	Number of Lakes	1
	Round Trip Distance from Lab (mi)	338
	Hours to visit each lake	9.8
	Staff Expense (2 Employees)	$837.41
	Vehicle Expense	$169.00
	Overnight Expense	$376.66
	Sample Analysis	$212.85
	Total Expense for single visit of all lakes	$1,595.92
	Single Year Sampling (6 visits)	$9,149.82
	Three Year Sampling (18 visits)	$27,449.46